## THE TRANSITION TO INDUSTRIAL FARMING LANDSAPES AND METHODS IN WESTERN LOWER MICHIGAN AND THE RESULTING COMMUNITY AWARENESS

By

Michelle Lynne-Larkins Jacques

## A THESIS

Submitted to Michigan State University in partial fulfillment of the requirements for the degree of

## **MASTER OF SCIENCE**

**Fisheries and Wildlife** 

## ABSTRACT

## THE TRANSITION TO INDUSTRIAL FARMING LANDSAPES AND METHODS IN WESTERN LOWER MICHIGAN AND THE RESULTING COMMUNITY AWARENESS

#### By

## **Michelle Lynne-Larkins Jacques**

Using an Environmental Justice Framework (EJF) and risk perception theory this research investigates the perceptions of residents of one West Michigan agricultural community regarding the density of Concentrated Animal Feeding Operations (CAFOs) in their area. Using a case study approach, semi-structured interviews (n=11) with operational stakeholders and orally administered surveys (n=296) with the community at large were conducted. Hispanic community members and farmworkers were purposively sampled due to their unique status in the community. Results indicate that community perceptions of risk differ significantly among demographic groups. Hispanic community members were more likely to perceive the employment benefits of CAFOS as being more important and the likelihood of environmental pollution or human health effects to be lower in importance than non-Hispanic community members. In contrast, women were more likely to perceive the pollution effects of CAFOs to be more significant and the economic benefits to be less important than men. Our findings support risk perception theory and also suggest directions for future research regarding educational attainment and perception.

Copyright by MICHELLE LYNNE-LARKINS JACQUES 2011 Dedicated in memory of my grandmother Jane F. Mitchell

#### ACKNOWLEDGEMENTS

I must begin by thanking my major professor, Dr. Tracy Dobson, who made my graduate career in the Fisheries and Wildlife Department possible. Her encouragement and wisdom helped me both in my thesis project and life in general. I feel truly blessed to have studied underneath her. I would also like to acknowledge my committee members, Dr. Carole Gibbs jointly appointed between the Department of Fisheries and Wildlife and the School of Criminal Justice, and Dr. Louie Rivers III of the School of Criminal Justice, for their invaluable assistance during the writing process and their support of my research. Thanks must also be given to a number of non-profit groups for their willingness to assist me in the community, especially Latin Americans United for Progress, The Migrant Resource Council, the Reciprocal Language Partnership, the Holland Farmer's Market, and the ECCSM.

A number of people provided emotional support along the way, thank you to Enid Evans, Franni Tourtellot, Sarah VanKuiken, and Marisa Rinkus. I would like to thank my family for their constant support of my educational endeavors, and most especially my parents, Betty and Gary Larkins for believing in me and my work. A special thanks to my husband Adam Jacques for his encouragement and love, and for providing a listening ear.

V

# TABLE OF CONTENTS

LIST OF TABLES	ix
LIST OF FIGURES	Х
Chapter 1	1
Introduction	1
CAFO Farming in West Michigan	2
Environmental Regulatory Structures	
Public Participation in CAFO Regulation	4
Environmental and Public Health Risks of CAFOS	6
Environmental Justice Movement	8
The Environmental Justice Framework	9
Regional Economic Structure	10
Research Objectives and Hypotheses	
Case Study Design	12
Study Area	15

Chapter 2	
Introduction	
Relevant Literature	
Methods and Research Design	
Research Area	
Methodology	
Data Sources	
Survey Sampling and Sampling Characteristics	
Survey Question Detail	
Results	
Hypothesis One: Variation in Risk Perception	
Hypothesis Two: Inverse Relationships	
Research Limitations	
Discussion	
Conclusion	

Chapter 3	
Conclusion of Thesis	
Additional Findings	
Archival Findings	
Qualitative Survey Findings	55

Future Research	
Research Limitations	59

APPENDICES	60
Appendix A: Semi-structured Interview Topics and Sample Questions	61
Appendix B: Stakeholder Representatives	64
Appendix C: Orally Administered Survey	65

BIBLIOGRAPHY
--------------

# LIST OF TABLES

Table 1- Summary of Sample Characteristics Compared to United States Census AmericanCommunity Survey 2005-2009 Data, by proportion (n=296)
Table 2: Likert Question Measures within Survey and Aggregate Response
Table 3: Force Ranking Categories and Aggregate Response41
Table 4: Summary of CAFO Risk and Benefit Perception Correlations using the Spearman rho   Rank Order Correlation Test (n=296)
Table 5: Summary of CAFO Rank Order of Importance Correlations using the Spearman rhoRank Order Correlation Test

## LIST OF FIGURES

Figure 1: Macatawa Watershed Boundaries	7
Figure 2: Power relationships between CAFO structure and communities	7

# LIST OF ABBREVIATIONS

CAFO	Concentrated Animal Feeding Operation
EJF	Environmental Justice Framework
EJM	Environmental Justice Movement
EPA	Environmental Protection Agency
GAAMP	Generally Accepted Agricultural Management Practices
MDA	Michigan Department of Agriculture
MDEQ	Michigan Department of Environmental Quality
MOU	Memorandum of Understanding
NPDES	National Pollutant Discharge Elimination System
USDA	United States Department of Agriculture

This thesis project investigates the risk and benefit perceptions of community members regarding the presence of Concentrated Animal Feeding Operations (CAFOs) in their local region. In this chapter I will begin by providing a description of this farming model, and how it is regulated at the federal and state level. Second, I will introduce the concepts of environmental justice, the resulting theoretical framework and its applicability to the study of CAFO presence in communities. This is followed by my research objectives and hypotheses. Next, I will provide a description of my research methodology, and study area. Chapter 2 contains an article that will be submitted for publication. A thorough literature review that includes a further discussion of an EJF and risk theory, and an analysis of the survey data collected can be found within the article. Chapter 3 is the conclusion of my thesis and includes results not mentioned within the article located in Chapter 2, as well as areas for future research.

#### Introduction

Concentrated Animal Feeding Operations (CAFOs) have become the dominant form of livestock agriculture farms in the United States. CAFOs, industrial mechanized farms, are characterized by their large number of animals contained in closed facilities, and an almost continuous cycle of production. Industrial agriculture models have allowed for exponential growth in farm scale and revenues, lower prices to consumers, and decreased transportation costs (Cochrane, 1993; Cole et. al, 2000). They have also resulted in fewer producers, a greater number of animals per farm, and the potential for uneven community socioeconomic impacts due to the regional concentration of farm systems (Lobao, 2000; Lobao and Meyer, 2001; McMichael, 2003).

In the last thirty years, the State of Michigan has realized considerable concentration in the number of these farms, especially in dairy and swine operations (Agriculture Census, United States Department of Agriculture). Research in other states which have experienced similar or greater rates of expansion has been fairly extensive (Wilson et al., 2002; Wing et al., 2000). In Michigan, research outside of production techniques has mostly focused on the effect of farms on property values (Abeles-Allison and Connor, 1990) and water quality (Oemke, et al., 2004). Studies performed in North Carolina, Mississippi, and Iowa, however, have documented a link between the concentration of CAFOs and marginalized communities, such as those with high populations of people of color and/or low incomes (Donham et al., 2007; Wilson et al., 2002; Wing et al., 2000,). This finding is consistent with environmental justice scholarship that links marginalized communities and other pollution hazards (Bryant and Mohai, 1992; Bullard, 1983; Gelobter, 1987; Goldman, 1994; UCC, 1987).

The purpose of this study was to investigate and describe using an Environmental Justice Framework (EJF), the response of residents within this region to the density of CAFOs in their community. Agricultural workers and the Hispanic population were of special interest. I specifically examined community perception of environmental and public health risks, the importance of CAFO economic contribution and other livelihood constructs. To place this research in context, I describe the presence of CAFOs in West Michigan, and the regulatory structure at the federal and state level.

#### **CAFO Farming in Western Michigan**

Two hundred and eight (n= 208) farming operations are permitted as CAFOs by the Michigan Department of Environmental Quality (NPDES Permit Database, MDEQ). Most

numerous are swine, dairy, and beef cattle operations. As contiguous counties, Allegan and Ottawa have the highest number of CAFOs in the state  $(n=35)^{1}$ . Within these two counties there are eighteen (n=18) CAFOs that are permitted as swine operations, making this the most popular farm type in the area. Additionally, these counties are ranked first and second for the total value of agriculture goods sold (Agriculture Census, United States Department of Agriculture).

## **Environmental Regulatory Structures**

## Federal.

Federal environmental regulation of these farm operations were first implemented in the early 1970's. Today, the Environmental Protection Agency (EPA), through its National Pollutant Discharge Elimination System, has regulatory authority over farms meeting the following size thresholds:

- A lot or facility where animals have been, are, or will be stabled or confined and fed or maintained for a total of 45 days or more in any 12 month period.
- Where crops, vegetation, forage growth, or post-harvest residues are not sustained over any portion of the lot facility in the normal growing season
- More than 1,000 animals units are confined at the facility, or
- From 301- 1000 animal units are confined at the facility and it also meets one of the specific criteria addressing the method of animal waste discharge

EPA CFR: Title 40, V.13, Parts 87 to 135. Section 122.23

Administration and review of the NPDES permit is performed at the state level, within the Water Bureau of the Michigan Department of Environmental Quality (MDEQ).

<sup>&</sup>lt;sup>1</sup> These two counties are both represented in our study area, which will be described in greater detail in a later section.

### Michigan.

In Michigan, the MDEQ and the Department of Agriculture (MDA) share regulatory oversight of CAFOs through a series of Memorandums of Understanding (MOUs). The MDEQ is responsible for site reviews and expansion requests, manure management inspections, and notification of pollution events where effluent is directly released into the waters of the state. The MDA works with producers to ensure that their operations are following Generally Accepted Agricultural Management Practices (GAAMPs), a requirement for permit renewal.

Under Michigan's Right to Farm Act, producers are protected from nuisance lawsuits, as long as they follow the GAAMPs as defined by the MDA. Adherence to GAAMPs and recordkeeping are self-regulated by the producer. The producer must file nutrient management plans and may be asked to show record-keeping documents upon site visits, but the accuracy of these documents does not need to be verified by agency staff.

### **Public Participation in CAFO Regulation**

Regulatory agencies and other units of government have oriented administrative proceedings toward incorporating public comment since the late 1940s (Blahna and Yonts-Shepard, 1989). This suggests that the goal of community participation in environmental decision-making should have been reached. However, the results of citizen participation efforts have been mixed, with some research suggesting that regulatory agencies may use public comment periods to reduce protest or market their preferred choice rather than to authentically deliberate with community members (Irvin and Stansbury, 2004). Community members are typically most likely to participate if they feel the political system is open, they have allies, and if

they can successfully navigate the web of powerful relationships within the political body (McAdams et al., 1996).

There are two points at which community members may participate in the regulatory structure of CAFOs in Michigan. The first is by lodging a citizen complaint related to any "observed" pollution. The MDA must investigate the farm within seven business days of the complaint receipt. If the producer is following the GAAMPs, the citizen complaint is dismissed. If the farmer is found to not be following GAAMPs, agency staff will work with the farmer to plan implementation of improvements within 30 days, to avoid official citation. If a citizen files a complaint three times for a farm, and these complaints are deemed unverified (farmer was found to be following GAAMPs), the citizen is required to pay the Agency the full cost of the total investigations (Michigan Public Act 93 of 1981). The content of citizen complaints and their geographic distribution are exempt from the Freedom of Information Act, which hampers the ability of community groups to gather knowledge of the operations in their area.

The second point at which the public may be involved is related to requests for expansion or new site development. In July, 2008, the Michigan Department of Environmental Quality (MDEQ) delivered its first permit denial for the siting or expansion of a CAFO under its NPDES permitting duties. The dairy operation was seeking to locate in St. Joseph County, and the denial of the permit was partially due to community input, both individual citizens and more organized stakeholder groups. Citizen concerns were voiced during the anti-degradation demonstration that is required by the MDEQ as part of the permitting process. The demonstration allows the farm owner to assert the ways in which the farming operation will bring benefit to the community in return for the potential risk to water quality. Below is an excerpt from a MDEQ press release (July 1, 2008) detailing the community input which aided the agency in its decision:

"One of the assertions in the antidegradation demonstration is that the CAFO will create jobs as a benefit; however, figures provided during the public comment period showed that any jobs provided by the CAFO will lower the median wage level in the township and replace higher paying jobs and family income at smaller farms. Another benefit given is that the CAFO will provide a long-term stable market for local crops and will help preserve rural character, open spaces, and wildlife habitat. This was also disputed by the public comments which demonstrated that hauling the large amount of manure over the township's roads will damage the rural character, and that the presence of the CAFO would result in a decline in property values and be detrimental to the sustainable tourism market in the area."

However, even where there is opportunity for the public to intervene in regulatory decisions there may be barriers for certain segments of the community. Research on public participation indicates that citizens who do participate are often from higher socioeconomic groups (Weber, 2000) or are paid consultants from business interests (Irvin and Stansbury, 2004). Other research has shown that low income community members may express reluctance to participate in meetings for which they are not paid (Russell and Vidler, 2000). The demographic differences in participation rates suggest that in some communities, especially those with low income residents, full community representation is unlikely. Further, researchers have noted that a lack of representation in decision-making processes, and/or feelings that community authority was not respected can lead to resentment and dissatisfaction (Davis, 1996; Smith and McDonough, 2001). The class differences in participation rates found by these researchers and the context leading to community dissatisfaction supports the importance of investigating community perception within an environmental justice frame.

#### **Environmental and Public Health Risks of CAFOs**

The USDA estimates the annual manure wastes of CAFOs in the US to be near 500 million tons—with the most frequent method of disposal being direct or injected ground application of the fecal matter for field fertilization (2008). In instances where waste has been

applied inappropriately or on-farm waste storage facilities have leaked, the influx of manure has been linked to ground water contamination, nutrient loading of nearby waters, algal blooms, and an artificial increase of biological oxygen demand (Campagnolo et al., 2002; Oemke, et al., 2004).

In addition to the ecological impacts, the presence and increased concentration of these types of farms in communities has been associated with human health effects linked to both air emissions and water pollution from agricultural effluent (Cole et al., 2000; Mirabelli et al., 2006). Nitrate is the most prevalent nutrient released from fecal matter into watersheds and is a dangerous contaminant to humans. Elevated nitrate levels in drinking water have been linked to hyperthyroidism, and methemoglobemia in infants (Kross et al., 1992). Ammonia emissions (NH4) are the dominant form of gas released into the air, but are not the only possible air pollution hazard. Recent studies concerned with the occupational exposure of farmworkers, catalogue the effects of bioaerosols (bacteria and fungi), non-biologic aerosols (animal feces, hair) as well as gases and vapors (ammonia)—all which have been linked to respiratory symptoms (Cole et al., 2000). Further, not only farm workers, but residents who live near farms may be at risk. Two recent reports from the University of North Carolina correlate the increase in asthma and asthma-related hospitalizations in children who attend schools within a five mile radius of a swine CAFO (Mirabelli et al., 2006).

Thus communities that are populated by CAFOs may be exposed to environmental and/or public health risks, and perceptions related to these types of risk were included in my investigation. These types of risks are similar to those of other environmental hazards, and thus environmental justice concerns are relevant to the discussion of CAFOs and their related risks. Following is an overview of the environmental justice movement, and its eventual development

into a theoretical framework used to investigate issues of social justice and the environment (Taylor, 2000).

#### **Environmental Justice Movement**

The environmental justice movement (EJM) emerged in the United States in the late 1970's and early 1980's, and represented a significant divergence from other popular environmental campaigns of the time. Beginning with The United Church of Christ's 1987 *Report on Race and Toxic Wastes in the United States*, a series of early environmental justice research studies demonstrated an association between the location of environmental hazards and marginalized communities (Bryant and Mohai, 1992; Bullard, 1983; Gelobter, 1987; Goldman, 1994; UCC, 1987). These studies argued that minorities and lower socioeconomic groups were disproportionately located near environmental hazards that could impact the health of their communities and families. By focusing on the impacts of environmental hazards on individual and community wellbeing, the EJM brought the environmental concerns of minority groups and lower socioeconomic classes to the forefront.

In addition to the investigation of geographic inequities, environmental justice based research is concerned with the level of procedural equity of community processes. Procedural equity is characterized by the usage of participatory decision-making bodies, informed participation through equal access to political/scientific/legal resources, the recognition of community knowledge, and the use of diverse participation formats to reflect the multiculturalism of the community (Bullard, 1990; Fraser, 1998; Shrader-Frechette, 2002; Schlosberg, 2007).

## **The Environmental Justice Framework**

The constructs of environmental justice have been modeled into a framework used for analysis of socio-environmental inequities (Taylor, 2000). In many ways the rhetoric of the EJF is borrowed from other civil rights discourses, as a means to attract the disenfranchised to the movement who may recognize this type of language, and due to the temporal origins of the EJM itself (Snow and Benford, 1992)<sup>2</sup>. For the purpose of this study, I based my interpretation of an EJF on the work of Dorceta Taylor (2000). She describes the environmental justice framework as a paradigm that includes the examination of geographic inequity, but extends to other community environmental concerns, such as housing or community education efforts. Second, Taylor argues that there may be interactions between race, sex, class, and other social characteristics (2000). Thus environmental justice research should adopt an investigative method which is more inclusive and representative of communities to enhance research sensitivity.

Applying an EJF to the existence of CAFOs in Michigan is critical as previous research efforts in this state have not integrated this scholarship; potentially overlooking location-based and participation based disparities. As the popularity of these farming systems continues, it is

 $<sup>^{2}</sup>$  A social justice orientation is apparent in most environmental justice organizations, and similarly, the types of remediation sought are more structural than episodic. The application of the EJF denotes an explicit recognition of the simultaneity of oppression, which can emanate from multiple sources and on the basis of multiple social biases (Taylor, 2000). An early model of the framework from Robert Bullard (1994) developed five basic elements inherent to the paradigm:

<sup>1.</sup> The right of all individuals to be protected from environmental degradation.

<sup>2.</sup> A public health model of prevention as the preferred strategy (no longer reactive but proactive).

<sup>3.</sup> The shift of the burden of proof of safety to the polluters and dischargers, whose activity harms, discriminates, or otherwise gives unequal protection to racial/ethnic minorities or other protected classes.

<sup>4.</sup> Allows disparate impact or other statistical measures to infer discrimination rather than the need to prove "intent".

<sup>5.</sup> Redresses disproportionate risk burdens through targeted action and resources.

important to investigate community perception to ensure that all affected stakeholders are being included in regulatory discussions. In reference to my study, this framework was applied in two ways<sup>3</sup>. First, the intent of my study was to collect community perceptions theoretically framed by environmental justice to begin a research discourse on CAFOs in Michigan. This incorporates an exploration of perceptions related to the environmental and public health risks as described earlier, and also explicitly includes an investigation of how the economic importance of this industry is perceived by residents. In addition to the EJF, I reviewed the literatures on risk perception theory, and resource mobilization<sup>4</sup>. The inclusion of risk perception theory complements a traditional EJF and can help to explain not only that groups may be operating and perceiving differently in a given socio-environmental context, but why. This leads to my second application of EJF— to recognize the particular socioeconomic context of farmworkers and Hispanic residents in the community—and how this may interact to influence their perceptions in ways unique within the community at large. A brief discussion of this context follows, and can be found in greater detail in Chapter 2.

### **Regional Economic Structure**

Ottawa and Allegan counties are the two most agriculturally productive counties in Michigan (US Agriculture Census, 2008). The high visibility of agriculture in this area, and its historic and contemporary economic importance make it likely that residents will have some

 $<sup>^{3}</sup>$  The purpose of this research was not to investigate the presence of any geographic inequities in the community. These relationships may exist, but were beyond the scope of my investigation.

<sup>&</sup>lt;sup>4</sup> Resource mobilization theory examines the processes and behaviors that lead to social movement/organization (Oberschall, 1973), and can help to explain why communities that are outside of political systems of power, or who have unequal access to resources may not *mobilize* against perceived harm to their community.

perception of this industry's impact in their community. Because of the amount of farming within my study boundaries, there is a high density of Hispanic migrant workers who depend on agricultural jobs for their livelihoods, and who locate transiently within these counties for the services provided<sup>5</sup> (US Census AS 2005-2009, Personal Interviews). Farmworkers and Hispanic residents in my study often display different perceptions than the community at large based, I infer, on a relative dependency on these types of jobs and related industries as discussed below.

Following the historic model of the *company town*, poor communities with few other employment prospects may be forced to choose between jobs and the environmental and public health of their communities (Sicotte, 2009). The lowest socioeconomic groups are those that are often most likely at risk, but are also the most likely to frame their personal risk assessments in terms of economic gain (Bullard 1990; Vaughn, 1993). Generally speaking there is a higher level of perceived trust of the relative environmental/public safety among those who are economically dependent on the jobs this source provides (Williams et al., 1999). Sokolowska and Tyzka (1995) found that low income community members are more likely to tolerate environmental/health risks if the tradeoff is local employment. Community members employed in these jobs may be versed in the environmental and health risk as their more educated neighbors, but differences in aspiration level will result in a more positive view of the "risky" technology for its economic necessity (Sokolowska and Tyzka, 1995; Vaughn, 1993).

## **Research Objectives and Hypotheses:**

<sup>&</sup>lt;sup>5</sup> There are levels of categorization within migrant worker status. Some workers are truly migrant by the season and do not return to the same farms. Other are labeled as Seasonal Agricultural Workers (SAW) who may work during the production season and then find other employment during the winter months/travel, but ultimately return to the same region and have a domicile there. Many of the SAW use social service agencies and try to transition into a more permanent resident status.

The purpose of this research was to investigate and document the response of a

community to CAFOs in their region. To that end, I integrate risk perception theory into the EJF

to increase understanding of how different demographic groups in the community may perceive

the risks and benefits of this industry. This contributes to the literature by specifically

investigating themes beyond proximity-based concern, and authentically measuring community

perspective. The main objectives of this study were:

- 1. to investigate the perceptions of the community regarding the existence of CAFOs within their locality.
- 2. to explore differences in perception that may be displayed by farmworkers and Hispanic residents

Related to these objectives, my specific hypotheses are:

- 1. that community members' perceptions of risks associated with CAFOs will vary by demographic group based on their situated social context, including gender, race, and farmworker status.
- 2. that farmworkers and Hispanic community members will display an inverse relationship between their risk and benefit perceptions associated with CAFOs. The dependency on these types of jobs and related industries, combined with positive affective feelings toward stable employment, will lead to an increased perception of benefit, and decreased perception of risk.

## **Case Study Design**

The article contained in Chapter 2 includes a thorough description of my survey instrument, and sampling methods. However, the survey was just one piece of the case study I completed for my thesis. Following is a description of the case study in its entirety, and references to appendices which include my interview guide, respondent categories, and survey.

I chose an exploratory case study design to test our hypotheses. This method allows me to integrate multiple sources of evidence and to investigate my questions within a "real life" context of a community (Yin, 1984). It is particularly useful when researching contemporary events or attitudes, because the researcher is grounded within the community and behavioral controls of

the respondents are unnecessary. The advantage to my research in using the case study design was the opportunity to combine interview, survey, archival evidence, and observation to describe the structure of the community (Yin, 1984, 2003), and to have more data with which to interpret community perceptions of industrial farming.

To address the concern of rigor, I used a research design employing mixed methods. The use of mixed methods in a case study increases the accuracy of interpretation, and when using several different strategies, may address gaps in other techniques. The data was collected in two primary phases and I employed both quantitative and qualitative methods. By staggering my data collection, I was able to use the first phase of data to inform and improve the second phase. The first data collection consisted of semi-structured interviews and archival research. The second was a combination of orally administered surveys, and participant observation. Archival research was used to complement and confirm statements from the interviews. Participant observation sessions included farmers' breakfasts, tours of CAFOs, migrant health clinics, migrant camps, and local governance meetings.

Semi-structured interviewing was important to my case study as it allowed the flexibility to probe respondents as new information was revealed, and the ability to adapt the interview guide to include important questions and themes unanticipated in the original draft (Maxwell, 2005). To reduce bias, I performed a series of four pilot interviews. Feedback was used to change question delivery methods, question wording, question sequencing, and the introduction given to respondents regarding my research project. All interview respondents were chosen through purposive sampling methods, and respondents chose the interview location and recording method.

A total of 11 interviews with stakeholders were completed. Interviews ranged in length from 30 minutes to over three hours. Each respondent represented a group or community role that was identified as integral to my research objectives; ranging from CAFO owners, migrant resource providers, to state and local governance. Questions covered four thematic areas: political positioning, economic impacts, environmental health knowledge, and public health knowledge. Text from these interviews was professionally transcribed, and then analyzed to categorize local social, economic, and political dynamics. A copy of my interview guide may be found in Appendix A. A list of the stakeholder representatives interviewed may be found at Appendix B. A copy of the survey may be found at Appendix C, and a discussion of its instrumentation in Chapter 2.

Analytical strategies for case studies are not as diverse as other research methods. Yin's foremost suggestion is to develop a strong theoretical proposition or framework to use as a guide when examining evidence (1984, 2003). As outlined above, the theoretical framework for this study is the environmental justice framework combined with theories of risk perception. Critics of case study methodology cite little ability to generalize scientifically with the data derived from this type of research. However, the intent with the case study design is to add validity to theories, and the applicability of these theories within a specific case (Yin, 1984, 2003). Turning to my case study, I can cite two areas for contribution. One is illustrating how the theoretical ideas of the inverse relationship of risk and benefit analysis and the primacy of economic need may affect judgments. The second is providing a report which might be used as a reference for others who are interested in the environmental justice implications of industrial farming in Michigan.

employed both the Spearman Rho Rank Order Correlation and Mann Whitney U tests over my quantitative survey data. These results may be found in Chapter 2.

### **Study Area**

Using the National Pollutant Discharge Elimination System (NPDES) electronic permit database, I mapped all the CAFOs within Allegan and Ottawa counties by animal species, size of operation, ownership, and the watershed the farm was contained in.<sup>6</sup>An analysis of this data led me to narrow my research efforts to the boundaries of the Macatawa Watershed, an area covering 175 square miles. A map of this watershed is provided at Figure 1. This watershed is the largest basin within the two counties, and is recognized by state and local governance as being compromised by phosphorous derived from fertilizer runoff, agricultural effluent, and other industrial inputs. Many CAFOs are within this watershed, providing a density of farms and farmworkers. These farms are also similar in size, scope, and ownership<sup>7</sup>. FOIA requests were submitted for management plans, and for any air and water pollution violations for farms within the study site. I used this information to ensure the homogeneity of the farm type/size. Second, I wanted to eliminate the possibility that a farm with multiple violations was within the study area, which could possibly skew my research results. Additionally, many of the social services agencies frequented by migrant workers are located within the watershed boundaries, in Holland, Michigan. This provided the opportunity for me to work with these agencies to gain entrance to

<sup>&</sup>lt;sup>6</sup> Under the Clean Water Act, CAFOs are required to be permitted under the NPDES system, and all farms requesting or renewing a permit are filed within an electronic database that is open to the public.

<sup>&</sup>lt;sup>7</sup> FOIA requests were submitted for management plans, and for any air and water pollution violations for farms within the study site. We used this information to ensure the homogeneity of the farm type/size. Second we wanted to eliminate the possibility that a farm with multiple violations was within our study area, which could possibly skew our research results.

the migrant community, and build trust within this community before beginning my research efforts.

For interpretation of the references to color in this and all other figures, the reader is referred to the electronic version of this thesis. Figure 1: Macatawa Watershed Boundaries (MDEQ, 2005)



### Introduction

Confined Animal Feeding Operations (CAFOs), have become the dominant form of livestock agriculture farms in the United States. CAFOs, industrial mechanized farms, are characterized by their large number of animals, livestock being contained in closed facilities, and an almost continuous cycle of production. Industrial agriculture models have allowed for exponential growth in farm scale and revenues, lower prices to consumers, and decreased transportation costs (Cochrane, 1993; Cole et al., 2000), but also fewer producers, a greater number of animals per farm, and the potential for uneven community socioeconomic impacts due to the changing regional concentration of farm systems (Lobao, 2000; Lobao and Meyer, 2001; McMichael, 2003).

Beginning in the early 1970's, researchers and advocacy groups began to voice concern that the concentration of these farms would create an imbalance between the ecological carrying capacity for waste absorption and the actual level of production (Cole et al., 2000). In addition to the ecological impacts, the presence and increased concentration of these types of farms in communities has been linked to: decreased property values, reduced small farm incomes, decreased air quality and compromised health in workers and local residents (Cole et al., 2000; Donham et al., 2007; Heederik et al., 2007; Lobao, 2000).

In the last thirty years, the State of Michigan has realized considerable concentration in the number of these farms, especially in dairy and swine operations. Research in other states that have experienced similar or greater rates of concentration has been fairly extensive (Donham et al., 2007, Heederik et al., 2007; Wing et al., 2000). In Michigan, research outside of production

techniques has mostly focused on the effect of farms on property values (Abeles-Allison and Connor, 1990) and water quality (Oemke et al., 2004). Studies performed in North Carolina, Mississippi, and Iowa, however, have documented an association between the concentration of CAFOs and marginalized communities, such as those with high populations of people of color and/or low incomes (Donham et al., 2007; Wilson et al., 2002, Wing et.al, 2000). This finding is consistent with environmental justice scholarship that links marginalized communities and other pollution hazards (Bryant and Mohai, 1992; Bullard, 1983; Gelobter, 1987; Goldman, 1990; UCC, 1987).

The environmental justice framework (EJF) is useful in analyzing particular CAFOs. One clear definition of the environmental justice theoretical framework (EJF) does not exist, but scholars, activists, and government agencies have all been involved in shaping environmental justice perspectives over the last three decades. Within the academic community specifically there is some dissension over the breadth of environmental concerns that should be investigated under an environmental justice frame, and which communities to include. Some scholars argue that the environmental justice perspective should not extend beyond the traditional examination of race and the presence of environmental hazards, contending that an extension of the frame would decrease its explanatory power (Getches and Pellow, 2002; Pellow and Brulle, 2005). However, other scholars assert that an EJF is applicable to investigations beyond simple race comparisons to include broad topics such as sustainable communities, healthy jobs, and recreational opportunities (Bryant 1995). The second approach represents an expansion of both who is environmental justice relevant to, and what types of environmental concerns can be studied. For the purpose of this study, we base our interpretation of an EJF on the work of Dorceta Taylor (2000). She describes the environmental justice framework as a paradigm that

can be used to investigate socio-environmental concerns (2000). This includes the examination of location-based hazards, defined as geographic inequity, but extends to other community environmental concerns. Second, Taylor argues that there may be interactions between race, sex, class, and other social characteristics, and thus environmental justice research should adopt a more holistic investigative method  $(2000)^8$ . This pluralistic framework has been supported by other scholars who, like Taylor, argue that a more inclusive approach could actually increase the explanatory power of an EJF (Schlosberg, 2007).

Most empirical research to date has focused on demonstrating cases of geographic inequity. However, concentrating on the disparate distribution of hazards excludes an equally important aspect of the environmental justice perspective—procedural equity. Procedural equity (or justice) includes the use of participatory decision-making bodies, informed participation through equal access to political/scientific/legal resources, recognition of community knowledge, as well as the use of various participation formats to reflect the multiculturalism of a community (Bullard, 1990; Fraser, 1998; Schlosberg, 2007; Shrader-Frechette, 2002). Strictly speaking, inclusion of citizen participation and comment periods in regulatory proceedings have been mandated, or strongly encouraged, in all levels of governance since 1946 (Blahna and Yonts-Shepard, 1989; Day, 1997; Irvin and Stansbury, 2004), suggesting that some degree of procedural equity already exists. However, some scholars argue that participation rates of marginalized groups in decision-making bodies may be severely limited by a lack of actual or

<sup>&</sup>lt;sup>8</sup> The use of "interaction" here should not be interpreted quantitatively, nor am I referring to the theory of intersectionality advanced in black feminist studies (Collins, 2006). Rather, Taylor (2000) and Schlosberg (2007) argue that by expanding the umbrella of justice to include more communities, it improves the application of an EJF. In their analysis improvement is accounted for by extending environmental justice theory to more people. Communities may have overlapping membership, and thus investigating intersections would be appropriate, but it is beyond the scope of this research.

perceived recognition from political structures (Bullard, 1993; Schlosberg, 2007). Thus, if one of the goals of environmental justice based research is to make environmental policy-making more inclusive, an important first step is to *investigate and include* perceptions of all community members.

In order to effectively investigate and understand perceptions of community members an academic knowledge of risk perception theory is essential. This field developed from the earlier disciplines of analysis, assessment, and decision-making (Slovic, 1987). Moving away from decision models created by technical experts, this scholarship seeks to understand the incorporation of sociocultural values into risk estimates, and recognizes that decisions are not always reached through logical analytical means (Finucane et al., 2000; Slovic, 1987). Importantly these theories can help to frame why different demographic groups may perceive risks and benefits at variable rates, and how these judgments are often related to other social ingroup affiliations (Wildavsky and Dake, 1990). Marginalized groups may be unique in their perceptions based on their socioeconomic status (Flynn et.al., 1994).

In addition to variation of perceptions related to social or demographic characteristics, researchers have found that an inverse relationship between risk and benefit perceptions often exists (Alhakami and Slovic, 1994). Some of the mediating factors in these judgments are related to the degree of control felt by the individual, their familiarity with the subject matter, as well as whether the risk is voluntary or involuntary (Starr 1969). However, most important to our research is the influence of economic rationalization to risk (Sokolowska and Tyzka, 1995). When economic benefit is perceived as significant by an individual, risk will likely be perceived as insignificant or tolerable. Last, as one of the scholarly aims of risk perception research is to improve communication between the lay public, risk experts, and policy makers (Slovic, 1987),

it supports the EJF and the pursuit of increasing procedural justice through group recognition and inclusion.

In the current study, we draw on an EJF and scholarship on risk perception to explore the perceptions of the risks and benefits of CAFO farming systems among community members within an agricultural region in West Michigan that is densely populated with these farms. Marginalized groups within the community are of special interest. Applying an EJF to the expansion of CAFOs in Michigan is critical as previous research efforts in this State have not integrated this scholarship, potentially overlooking location or participation-based disparities. The inclusion of risk perception theory complements the traditional EJF and can help to explain not only that groups may be operating and perceiving differently in a given socio-environmental context, but why. The exploratory case study presented here begins with a review of the EJF and risk perception literatures. This is followed by an analysis of an orally administered survey (n = 296) that investigated community members' perceptions of the impact of CAFOs within their locality and a discussion of the relevant results.

### **Relevant Literature**

Early environmental justice research focused on the physical relationship between race and the presence of pollution (Bryant and Mohai, 1992; Bullard, 1983; GAO, 1983; Gelobter, 1987; Goldman, 1990; UCC, 1987). These studies argued that minorities and lower socioeconomic groups were disproportionately located near environmental hazards that could impact the health of their communities and families. Most researchers relied on simplistic measures of proximity to an environmental hazard as the indicator of environmental injustice. Somewhat endemic to this early body of research was the interpretation that the correlation demonstrated between hazard location and a marginalized population was evidence of causation. Methodology has improved, with some experts using more sophisticated geographic techniques to investigate and explain the persistence of these inequities (Mohai and Saha, 2006) and finer gauges of toxicity (Ash and Fetter, 2004). While these more rigorous studies continue to find correlation between race/class and the presence of environmental hazards (Mohai and Saha, 2006, 2007), they do not empirically examine potential societal barriers to marginalized group participation.

Environmental justice scholars argue that full community participation in environmental decision-making and the authentic representation of community perspectives therein, is requisite to achieving procedural equity (Bullard, 1993; Hunold and Young, 1998; Schlosberg, 2007). As mentioned in the introduction, regulatory agencies and other units of government have oriented administrative proceedings toward incorporating public comment. This would suggest that the goal of full community participation in environmental decision-making should have been reached. However, the results of citizen participation efforts have been mixed, with some research suggesting that elites and partisan interests are overrepresented in these processes (Weber, 2000), and that regulatory agencies may misuse public comment periods by advocating for their preferred plan rather than authentically deliberating with community members (Irvin and Stansbury, 2004). Citizens who do participate are often from higher socioeconomic groups (Weber 2000) or may be paid consultants from business interests (Irvin and Stansbury, 2004). Other research has shown that low income community members may express reluctance to participate in meetings for which they are not paid (Russell and Vidler, 2000). In support of procedural equity claims, researchers have noted that a lack of representation in decision-making processes, and/or feelings that community authority was not respected can lead to resentment and

dissatisfaction (Davis, 1996; Smith and McDonough, 2001). The class differences in participation rates found by these researchers and the context leading to community dissatisfaction supports the importance of investigating community perception within an EJF.

Yet, only recently have some environmental justice researchers begun to investigate public perception not explicitly tied to a proximity-based framework, suggesting a gap in the literature. Jones and Rainey (2006) critique the exclusive emphasis on the differential exposure hypothesis in environmental justice studies. Instead, they argue that sociopolitical factors may mediate perceptions of environmental risk/concern, and thus perception should be included within environmental justice research to better understand community dynamics<sup>9</sup>. In their study of the Red River Community (RRC), a highly polluted area comprised mainly of people of color and lower socioeconomic status, they explored environmental/public health concern and perceptions of injustice between black and white residents. The researchers demonstrated that higher levels of environmental concern were present in black residents of RRC. Nonetheless, these authors argue for further research exploring perceptions among more diverse socio-demographic groups to move beyond the classic race comparisons.

Building on this foundational study, our research includes other characteristics that may influence perception such as gender, educational attainment, and livelihood measures. Using the broader issue lens described by Taylor (2000), we move beyond a quantitative investigation of geographic inequity. Combining these two concepts in our research frame allows us to

<sup>&</sup>lt;sup>9</sup> There is a wide body of literature related to environmental concern dating to the 1970's, but until recently the effect of race and ethnicity on environmental concern level was not well studied (Jones, 1998, 2002; Jones & Carter, 1994; Mohai, 2003). Jones and Rainey (2006) explicitly structure their perception/concern research within the environmental justice paradigm, moving beyond the typical frame of concern based research. They further distance themselves from traditional environmental justice frame by including concern/perception measurement constructs that are not wholly based on the differential exposure hypothesis (Jones and Rainey, 2006).

investigate the environmental perceptions of the community holistically, and extends our investigation beyond traditional race comparisons. Further, as a measurement construct, we focus on individual risk perception, rather than level of concern. This distinction is important as concern is a variable that may influence *perception* (Rivers et al., 2010), but a more holistic analysis of environmental risk perception includes examination of social context, demographic characteristics, and other subjective factors. Additionally, within the field of environmental concern there is some disagreement as to what 'concern' actually measures, with some scholars arguing that the lack of construct specificity hampers findings (Mohai and Twight, 1986; Samdahl and Robertson, 1989)<sup>10</sup>. To that end, we integrate risk perception theory into the EJF to increase our understanding of community response to CAFOs. This contributes to the literature by specifically investigating themes beyond proximity-based concern, and authentically measuring community perspective.

The field of risk perception seeks to explain why individuals judge certain activities to be advantageous, or hazardous (Slovic et al., 1982). This theoretical framework is a departure from other risk sciences, such as assessment, which focused on identifying, quantifying, and characterizing risk using highly scientific and technical parameters (Slovic, 1987). Early risk choice models assumed that lay people, like technical experts would employ probability and expected utility theories within their decision-making (Loewenstein et.al, 2001). What risk perception researchers found is that an individual's perception of risk is different than the technical "reality" of the risk, and that this difference can be partially attributed to the inherent inclusion of their values and emotions (Fischoff, 1995). Thus previous risk estimate models that

<sup>&</sup>lt;sup>10</sup> Concern as a measurement construct is often described as perception of a problem, support for regulation, and environmental behavior (Samdahl and Robertson, 1989). Problematically, these may all be combined in one study and they may fail to incorporate the theoretical paradigm of perception.

included only expert analysis often lacked meaning to the general public, and were used primarily by governance agencies. Including the public's interpretation of risk can redefine relationships between communities and policy makers, as it recognizes their reality and their situated knowledge (Fischoff, 1995). While research is being conducted on the subjective assumptions of experts in their own risk perceptions (Wright et al., 2002) the emphasis within this field is describing and understanding the variations and mechanisms which influence the risk judgments of the general public in an effort to improve communication (Slovic, 1987).

Toward this end, studies indicate that the social context which the individual is embedded within is often a predictor of their judgment (Flynn et.al., 1994; Slovic, 1987; Wildavsky and Dake, 1990). Risk identity and variation within perception is framed by an individual's social network and their collectively held values and ideologies (Wildavsky and Dake, 1990). These networks may be organized professionally, socially, educationally, or within a family, among other identities. Perceptions will most likely reflect whatever choice reinforces their cultural status quo, including worldviews, and political orientations. These same factors— ideologies, values, and worldviews—are found to be consistent predictors within the research discipline of environmental concern (Dietz, Stern, and Guagnano, 1998; Stern 1992). Within this body of literature, social psychological variables such as values and worldviews typically explain a larger variance in the concern levels of respondents than sociodemographic variables (gender, income, education), but are less well studied due to data availability constraints (Dietz et al., 1992)<sup>11</sup>.

Worldview within risk literature refers to three orientations or frameworks— egalitarian, individualistic, or hierarchal—which highly influence perception (Slovic and Peters, 1998).

<sup>11</sup> Broad national samples, such as the General Social Survey (GSS) often used by researchers in this field, contain sufficient demographic variation and sample size but do not contain variables that effectively measure values and beliefs.
Individuals who hold an egalitarian worldview will tend to judge any societal risk critically, while individualistic or hierarchal worldviews typically privilege self-regulation and expert management (Finucane, et al., 2000; Wildavsky and Dake, 1990). Individualistic and hierarchal worldviews are categorized as being more trusting of technology and less trusting of public participation and democratically controlled forms of government, preferring decision-making power to be held by authorities (Finucane, et al., 2000). Generally, individuals who possess these latter two orientations will have lower risk perceptions compared to the perceptions of those with an egalitarian worldview. Thus these orientations, combined with other socially embedded networks, can influence what is seen as "risky", and elevate some concerns, including environmental or health, over others.

Combined with sociopolitical mediations of risk perception, research has shown a distinct difference in the risk perceptions of women and minority groups in comparison to elite white males. Explained as the White Male Effect (WME), the risk perceptions of some white males are found to be universally low across a range of technologies and hazards (Flynn et.al., 1994). For this select group—that possesses greater levels of education, status, income, and political conservatism— industry and technology are seen as less "risky" as these white males are more likely to benefit economically, to manage processes as experts, and reside far enough away to be safe from harm (Finucane et.al., 2000; Flynn et al., 1994). White males within this elite group also tend to display individualistic or hierarchal worldviews as discussed above (Rivers et al., 2010). This same body of research has demonstrated that race and gender remain significant in predicting level of risk perception even when controlling for the effects of education, income, age, and political orientation (Finucane et.al, 2000; Flynn, 1994). Some of this difference is attributed to the relative lack of female and minority representation among policy-makers and

within institutions of power (Finucane et al., 2000; Flynn et al., 1994; Johnson, 2002). Of particular relevance to our research are the findings that suggest that the risk perceptions of women are elevated when the environmental hazard is located within their community versus a generic environmental issue (Bord and O'Connor, 1992; Hamilton, 1985a, 1985b; MacGregor et.al., 1994). Thus within our study, where we are investigating perceptions related to the impacts of local CAFOs, women may display higher environmental risk perceptions.

Nonetheless, while some generalizations can be made by race or gender, these differences and the predictive power of the WME cannot be separated from the significance of the social context within which these groups are embedded<sup>12</sup>. White men who do not possess the same advantages or worldviews as their more privileged cohorts are not likely to have the same individualistic or hierarchal risk perceptions. It is also problematic to assume that all women or racial/ethnic minorities will display homogenized perceptions. Just as risk perception will vary by object or issue, so too individual variation will occur based on the combination of demographic and social contexts. Most environmental justice research has neglected to investigate public perception of environmental risks and associated health hazards, assuming instead that proximal location to pollution is the driving factor of opinion (Jones and Rainey, 2006). By framing our research within risk perception, a body of theory that acknowledges the social and biological contexts that mediate and frame opinions, it extends and enriches the EJF.

Drawing on the literature reviewed above, our first research objective is to investigate and collect the perceptions of the community regarding the existence of CAFOs within their

<sup>&</sup>lt;sup>12</sup> This is consistent with the research studies within the environmental concern literature that finds women (Blocker and Eckberg, 1997) to generally have higher levels of concern than men and minorities to display higher levels of concern than whites (Jones, 1998; Jones and Carter, 1994) but maintains that knowledge, worldviews and beliefs (social psychological variables) are a more consistent and reliable measurement construct (Blocker and Eckberg, 1997, Dietz et al., 1998).

locality. We hypothesize that community members' perceptions of risks associated with CAFOs will vary by demographic group based on their situated social context. In keeping with our application of a broad EJF, we included gender, race, education, and livelihood measures within our investigation. Women may be more likely to display higher risk perceptions due to the local focus of our research. For our investigation of perceptions related to race, the Hispanic population is the largest minority group in our study area (US Census ACS 2005-2009) and thus within this research is identified as the minority group of interest. Previous research has indicated that minorities may display higher risk perceptions (Flynn, et al., 1994). However, consistent with the further analysis of risk perception theory discussed below, we hypothesize that members of the Hispanic community will display *lower* risk perceptions. Second, within this community there is a high density of migrant workers who depend on agricultural jobs for their livelihoods and who reside transiently within these counties for the services provided  $^{13}$  (US Census ACS 2005-2009, Personal Interviews). For our investigation, we purposively sampled farmworkers and Hispanic residents, anticipating some overlap between the two populations. Based on our further review of risk perception theory that follows, both of these populations may display perceptions that are different than the community at large.

In addition to variation in the perception of risk, there may also be variation in perception of benefits associated with CAFOs. Alhakami and Slovic (1994) documented the inverse

<sup>&</sup>lt;sup>13</sup> There are levels of categorization within migrant worker status. Some workers are truly migrant by the season and do not return to the same farms. Other are labeled as Seasonal Agricultural Workers (SAW) who may work during the production season and then find other employment during the winter months/travel, but ultimately return to the same region and have a domicile there. Many of the SAW use social service agencies and try to transition into a more permanent resident status. There are also tenured Hispanic residents in this community. However as will be described later, within our sampling frame we specifically targeted Hispanic community members who were patrons of social service agencies geared toward migrant workers.

relationship of benefit and risk in people's minds, disputing the analytic approach to this association that would claim individuals treat these concepts independently. Rather, as perceived benefit increases, to mediate cognitive dissonance, the perception of risk is often lowered. Indeed, the perception of benefit is often the most important determinant of an individual's risk classification. If benefits are present, and the level of risk is viewed as tolerable, acceptance is likely (Frewer, 1999). The presence of the affect heuristic in risk perception and decision-making is linked to these judgments. Activities which cue positive emotional responses are more likely to be viewed as high benefit and low risk (Finucane et al., 2000). Within our study, this inverse relationship may exist especially for farmworkers and Hispanic residents who would view employment within the agricultural industry as beneficial despite any knowledge of risks, and a positive emotional response to employment is likely. This association is supported further by the socioeconomic primacy of agriculture in the region.

In the historic model of the *company town*, poor communities with few other employment prospects would be forced to choose between jobs and the environmental and public health of their communities (Sicotte, 2009). There is a higher level of perceived trust of the relative environmental/public safety among those who are economically dependent on the jobs this source provides (Williams et al., 1999). These same residents are more willing to accept increased public/environmental health risk for economic gains. Low income community members are more likely to tolerate environmental/health risks if the tradeoff is local employment (Sokolowska and Tyzka, 1995). Community members employed in these jobs may be as well versed in the environmental and health risk as their more educated neighbors, but differences in aspiration level will result in a more positive view of the "risky" technology for its economic necessity (Sokolowska and Tyzka, 1995; Vaughn, 1993). Research has shown that in

areas where there is little opportunity available for alternate employment, workers are less likely to take any self-protective measures, choosing to adapt to the risk or focus solely on the economic benefit to their family (Vaughn, 1993). Low income community members are those who are most likely at risk, but are also the most likely to frame their personal risk assessments in terms of economic gain (Bullard 1990; Vaughn, 1993). Within the environmental justice literature, this phenomenon is described as the economic contingency hypothesis, which holds that during times of economic recession, or dependency on certain employers, support for environmental protections declines (Jones & Dunlap, 1992). The increase of fear and anxiety felt within communities when they associate the strengthening of environmental regulations with the loss of jobs has been similarly documented (Brown, 1980).

It has been empirically demonstrated that minorities and other marginalized groups often display higher perceptions of risk (Flynn et al., 1994). However, the perceived benefit of employment may induce an inverse relationship in individual risk perceptions, as described by Alhakami and Slovic (1994). Second, economic rationalization of environmental and health related risks is more likely among farmworkers and Hispanic residents in our study area, than the community at large (Sokolowska and Tyzka, 1995; Vaughn, 1993). Thus marginalized groups in our research area may actually display lower risk perception. Therefore our second hypothesis is that farmworkers and Hispanic residents will display an inverse relationship between their risk and benefit perceptions associated with CAFOs. The dependency on these types of jobs and related industries, combined with positive affective feelings toward stable employment, will lead to an increased perception of benefit, and decreased perception of risk.

To reiterate, the primary aim of this research is to combine the EJF with risk perception theory to investigate the perceptions of a community in Michigan impacted by CAFOs. We

believe that perceptions will vary among community residents based on their demographic status and social context. In addition to the general observed tendency of women to exhibit higher risk perceptions, the perception of women in our study may be influenced by the specific community context of our research. Within marginalized groups, perceptions will be further influenced by economic ties. The following section describes our methodological approach and survey instrument, beginning with the design of our research area. As discussed in greater detail below, we employed an exploratory case study model. This research strategy is location specific, requiring a well-bounded study area.

### Methods and Research Design

### **Research Area**

Our study site includes Ottawa and Allegan counties, the two most agriculturally productive counties in Michigan (USDA Agricultural Census, 2008). The high visibility of agriculture within the community, and its historic and contemporary economic importance make it likely that residents will have some opinion or perception of this industry. Using the National Pollutant Discharge Elimination System (NPDES) electronic permit database, we mapped all the CAFOs within Allegan and Ottawa counties by animal species, size of operation, ownership, and watershed<sup>14</sup>. An analysis of this data led us to narrow our research efforts to the boundaries of the Macatawa Watershed, an area covering 175 square miles. This watershed is the largest basin within the two counties, and is recognized by State and local governance as being compromised by phosphorous derived from fertilizer runoff, agricultural effluent, and other industrial inputs.

<sup>&</sup>lt;sup>14</sup> Under the Clean Water Act, CAFOs are required to be permitted under the NPDES system, and all farms requesting or renewing a permit are filed within an electronic database that is open to the public.

Many CAFOs are within this watershed, providing a density of farms and farmworkers. These farms are also similar in size, scope, and ownership<sup>15</sup>. Additionally, many of the social services agencies frequented by migrant workers are located within the watershed boundaries, in Holland, Michigan.

### Methodology

We chose an exploratory case study design to test our two hypotheses. This methodology allows us to integrate multiple sources of evidence and to investigate our questions within a "real life" context of a community (Yin, 1984). It is particularly useful when researching contemporary events or attitudes because the researcher is grounded within the community and behavioral controls of the respondents are unnecessary. Critics of case study methodology cite little ability to generalize scientifically with the data derived from this type of research. However, the intent with this methodological design is to add validity to theories, and demonstrate the applicability of these theories within a specific case (Yin, 1984, 2003). We employed both quantitative and qualitative methods in a sequential pattern, using the first set of data collection to inform the second. The use of mixed methods in our research was intended to reduce the bias often present in a single collection strategy, and to capitalize on the strengths of different instruments (Axinn and Pearce, 2006; Rosenbaum, 2001).

### **Data Sources**

Our data was collected in two primary phases. The first consisted of semi-structured interviews and archival research. The second was a combination of orally administered surveys

<sup>&</sup>lt;sup>15</sup> FOIA requests were submitted for management plans, and for any air and water pollution violations for farms within the study site. We used this information to ensure the homogeneity of the farm type/size. Second we wanted to eliminate the possibility that a farm with multiple violations was within our study area, which could possibly skew our research results.

and participant observation. The intent of the semi-structured interview was to derive location specific themes and to inform the question construction of our survey.<sup>16</sup> A total of 11 interviews with stakeholders were completed. Interviews ranged in length from 30 minutes to over three hours. Text from these interviews was professionally transcribed and then analyzed to categorize local social, economic, and political dynamics. Archival research was used to complement and confirm statements from the interviews. Participant observation included farmers' breakfasts<sup>17</sup>, tours of CAFOs, migrant health clinics, and local governance meetings. The survey was used to collect attitude and perception data for statistical analysis, and is the focus of the remainder of this section.

### **Survey Sampling and Sampling Characteristics**

Respondents were recruited using two distinct methods. The first was targeted sampling within our defined study area. Sites selected for this round of sampling included locations such as: coffee shops, the local farmer's market, a community center, a soup kitchen, and shopping districts within downtown Holland. These sites were targeted for their high degree of pedestrian

<sup>&</sup>lt;sup>16</sup> A primary finding that came from our interview data was that the term CAFO carried political connotations depending on the audience. Thus during survey administration the term was orally explained to respondents using the Environmental Protection Agency's (EPA) regulatory definition, and within the survey questions referred to as an industrial animal farm. Respondents were also given a paper copy of the EPA definition to refer back to during survey administration. Industrial animal farm was defined as:

<sup>•</sup> A farm where 300- 1000 animals are kept and fed for a total of 45 days or more inside.

<sup>•</sup> The animals, feed, manure, and production operations are on a small land area. Feed is brought to the animals rather than the animals grazing in pastures, fields, or on rangeland

<sup>&</sup>lt;sup>17</sup> Farmers' breakfasts are events sponsored by local units of environmental and agricultural governance (such as Conservation Districts) to gather farmers, and field agents for hot topics and question and answer sessions. These events are not open to the general public, but by invitation we were allowed to take part.

traffic and second and because most respondents would be frequenting these locations during their free time. We varied time of day to reach different segments of the population, and certain venues, such as the soup kitchen, were included in an attempt to reach low income residents. Second, we performed purposive sampling to increase the representation of farmworkers, and Hispanic residents in our study. The survey was available in both English and Spanish and on our purposive sampling days a translator accompanied the researchers. Due to timing constraints, many of the migrant agricultural workers had left for the season when we began surveying in late October, 2010. However, we did make two site visits to migrant camps where workers were still present and were able to collect survey responses.<sup>18</sup> To supplement our sampling of this population, we made over 15 visits to social service agencies that aid ESL speakers in the community. Respondents recruited from these agencies were members of ESL or GED preparation classes, seeking employment counseling, or walk-ins.

Three hundred and forty (n=340) survey attempts were made over a period of four months, and of these three hundred and thirty-seven (n= 337) were collected, for a 99.11% response rate. Two hundred and ninety six (n= 296) of these surveys were deemed complete. Demographic information was voluntarily collected from all respondents including race/ethnicity, gender, language preferred for communication, agricultural worker status, and educational attainment. Respondents were not limited in their selection of race or ethnicity categories, consistent with the most recent US Census guidelines. No respondents indicated that they identified as two or more races. Further, no one who identified as "Hispanic or Latino" indicated that they also identified with another racial category. We chose to collapse our data into a race/ethnicity binary (Hispanic or Latino or Non-Hispanic/Latino). Approximately 8.0% of

 $<sup>^{18}</sup>$  We also performed an in-depth interview with one respondent at these locations.

our sample indicated a race/ethnicity other than white or Hispanic, providing too few respondents for statistical analysis if treated separately. Further, as stated in our research objectives we are specifically interested in investigating if differences in perceptions exist within the Hispanic population, versus the community at large. Thus our treatment of this data category is consistent with stated research objectives.

Our sample is comparable to the available Census statistics representing Allegan and Ottawa counties, with only a percentage point separating the three sets of gender data. Upon visual inspection, there appears to be discrepancy between our sample and the county representation related to those respondents who indicated that they had a High School Diploma or GED, with our sample representation being somewhat lower. However, within our sample, 49 respondents or 16.6% of the sample were unwilling to indicate their educational attainment. It is likely that the variation in sample representation is from this missing data, as all other education levels are similar to the Census data. Hispanic farmworkers were the most frequent demographic group that omitted this information.

We purposively sampled the Hispanic population. Thus the variation between our sample—17.2% Hispanic respondents—and the 8.0% representation in Ottawa County, and 6.6% in Allegan County is expected. The demographic category "Agricultural Worker Status" was likely under-reported, as some of the Hispanic respondents expressed anxiety in indicating their employment status, and asked that their survey be marked as "no".<sup>19</sup> A summary table of the demographic characteristics of the survey sample is below (see Table 1).

<sup>&</sup>lt;sup>19</sup> Three of our interview respondents who represented larger stakeholder groups made reference to some community tension regarding Hispanic farmworkers in the community, and the possibility of unauthorized employment status. None on these respondents represented the Hispanic community.

### **Survey Question Detail**

The survey consisted of 13 questions, a mix of 5-point Likert scale and open-ended responses. Open-ended questions were included to elicit relationships between variables and to give the respondents flexibility of providing specific location examples of the effect of industrial farms on their community that could not be derived from a scale. The response categories on the Likert scale were varied with each question in an effort to diminish complacency in the respondent.

The content of our survey questions was derived from an extensive review of the literature related to the impacts of CAFOs on communities (Campagnolo et al., 2002; Cole et al., 2000; Donham et al., 2007; Heederik et al., 2007; Kross, 1992; Lobao, 2000; Oemke et al., 2004; Wilson et.al., 2002; Wing et al., 2000), and from our interview data. Both of these data sources suggested concern about pollution/health related impacts and the economic effects of CAFOs in communities. Studies link the presence of CAFOs to an increase in both air and water pollution events (Campagnolo et al., 2002; Kross, 1992; Mirabelli et al., 2006; Oemke, et.al., 2004), and in many cases these events can be hazardous to both ecological and human health (Cole et.al., 2000; Kross, 1992; Mirabelli et al., 2000).

As our exploration of risk we chose to analyze the perceptions of the potential for CAFOs to impact environmental and public health (see Table 2).<sup>20</sup> An individual's risk perception is the product of their personal judgment of the *probability* of an event occurring multiplied by the

<sup>&</sup>lt;sup>20</sup> While we were unable to pilot our survey, we were able to gauge our question structure against an eighteen page survey that had been delivered throughout the region to 547 landowners/farmers in the previous year. This survey included questions related to water quality and land management. It was revealed that some farmers were upset by the question structure that forced respondents to indicate what level of pollution was associated with farming practices. Thus in that we would be sampling some of the same population, we included a more neutral response category within our range of choices that indicated environmental or health impacts were impossible.

*consequence* they attribute to the potential event's impact (Arvai, 2007). Rather than using the word "risk," within our survey questions, we used explicit terminology to describe the potential consequences of CAFOs. This avoided personal or biased interpretations of a somewhat nebulous term (risk). A second set of questions were framed as potential benefits to the community—the economic contribution to the community from CAFOs, and the potential effect on property values (see Table 2). A final question asked the respondent to force rank four CAFO impacts in terms of their individual importance and to rate this impact as positive or negative (see Table 3). These impacts were consistent with the themes explored in the other survey questions and provided a confirmatory measure of the respondent's primary concern related to our survey content. However, several respondents failed to indicate ranks of third or fourth importance. This response rate is reflected within our results.

We chose to analyze our Likert responses as ordinal data using the median response, rather than assume normality between responses on an interval scale (Jamieson, 2004). We calculated the Spearman Rho Rank Order Correlation and the Mann Whitney U tests for all questions that used a Likert type scale, for each demographic variable. Both of these statistical measures are appropriate for deriving significance from ordinal data (Pallant, 2007), and used in conjunction increases the validity of our results.

	Variable	Sample	21	22
Demographic Variable	Code	Representation	Ottawa County <sup>21</sup>	Allegan County <sup>22</sup>
		$\bar{x}$ (STD)		
Race/Ethnicity		0.828(0.378)	0.920	0.934
Hispanic or Latino	0			
Non-Hispanic	1			
Sex		0.507(0.500)	0.492	0.501
Female	0			
Male	1			
Primary Language		0.851(0.356)	0.908	0.937
Spoken				
Spanish	0			
English	1			
Agricultural Worker		0.801(0.400)	0.980	0.969
Status				
Farmworker	0			
Non-farmworker	1			
Educational Attainment		1.862 (0.909)		
Did not graduate HS	0	0.074	0.098	0.126
HS diploma or GED	1	0.186	0.318	0.376
Some College	2	0.355	0.299	0.301
Bachelor's or Higher	3	0.219	0.284	0.197
Did not Respond*	N/A	0.166**	N/A	N/A

**Table 1**: Summary of Sample Characteristics Compared to United States Census American

 Community Survey 2005-2009 Data, by proportion (n=296)

\*49 respondents, or 16.6% of the sample, were unwilling to indicate educational attainment

\_\_\_\_\_

<sup>&</sup>lt;sup>21</sup> ACS 2005-2009 Census data reported as proportional percentages.

<sup>&</sup>lt;sup>22</sup> ACS 2005-2009 Census data reported as proportional percentages.

	$\bar{x}$ (STD)	
Question (survey code)	Mdn	Measure
Risk		
In your opinion which statement best describes the possibility for industrial farms to pollute the environment? ( <i>Environmental</i> <i>Pollution Effect</i> )	2.25(0.941) 2.00	1= Definite, 5= Improbable or Impossible
In your opinion which statement best describes the possibility for industrial farms to have an effect on human health? (Human Health Effect)	2.34(0.995) 2.00	1= Definite, 5= Improbable or Impossible
Potential Benefits		
How would you rate the importance of the economic contribution of industrial farms to this community? ( <i>Economic Contribution</i> )	3.80(0.941) 4.00	1= Not important, 5= Very important
In your opinion which statement best describes the effect industrial farms in this area may have on property values? ( <i>Property Value Effect</i> )	2.55(0.948) 2.00	1= Very negative, 5= Very positive

Table 2: Likert Question Measures within Survey and Aggregate Respon	nse
--	-----

Table 3: Force Ranking Categories and Aggregate Response				
When I think about the impact of				
industrial farms in my community, I				
think this is most important issue: (1=	$\bar{\mathbf{x}}$ (STD)			
Most Important, 4 = Least Important)	Mdn			
Environmental Impact	2.16(1.069)			
	2.00			
Community Human Health Impact	2.41(1.131)			
	2.00			
Regional Economic Impact	2.76(1.116)			
	3.00			
Provider of Jobs in the Community	2.56(1.101)			
Impact	3.00			

# Table 3: Force Ranking Categories and Aggregate Response

#### Results

### Hypothesis One: Variation in Risk Perception

Consistent with hypothesis one, we found significant differences in the risk perceptions of CAFOS among community members. As expected, women perceived the pollution potential of CAFOs to be more definitive than men (r = 0.173, p < 0.01). Women also perceived a greater likelihood of the potential for CAFOs to affect human health than men, but this result was not significant (see Table 4). Similarly, women were more likely to rank the environmental impact of CAFOs in the community as the most important issue (r=0.135, p<0.05). This result can be found in Table 5.

Overall respondents with higher levels of education were more likely to perceive environmental pollution and human health effects as more probable. However, only one association—the potential for these farms to pollute the environment— reached statistical significance (r = -0.167, p < 0.01).

Hispanic residents displayed significantly different risk perceptions from non-Hispanic residents. Hispanic community members perceived a lower likelihood of environmental pollution (r= -0.127, p <0.05), and effects on human health (r=-0.130, p<0.05) from CAFOs being present in the community (see Table 4).

No statistically significant relationships were found to exist between farmworker status and the risk perceptions of CAFOs within the community. The directions of the correlations were consistent with expectations based on our theoretical framing, but failed to reach a level of significance. This is likely due to the small sample size.

### **Hypothesis Two: Inverse Relationships**

Under hypothesis two we expected that Hispanic community members and farmworkers would display an inverse relationship between their risks and benefit perceptions. We had no significant findings related to farmworker status; however, there were additional findings related to gender.

Hispanic community members displayed an inverse relationship between their perceptions of risk and benefit related to CAFOs. As reported above, Hispanic community members were significantly less likely to associate environmental pollution or effects to human health effects with CAFOs. Hispanic residents perceived the economic impacts to be more important than non-Hispanic residents (see Table 4). Under the question of rank order, Hispanic residents were much more likely to attribute importance to CAFO provision of jobs in the community than non-Hispanics (see Table 5). The effect size of this relationship (r= 0.255) is the greatest of any of our correlation tests, as is the level of significance (p < 0.0001). This finding is consistent with the expectation under hypothesis two that Hispanic community members' perceptions may be affected by the importance placed on agricultural employment (see Table 5).

We did not anticipate a relationship between gender and perception of potential CAFO benefits, but these results are worth exploring due to the contrast with the Hispanic population. Women perceived the economic contribution of CAFOs to be less important (r=0.141, p<0.05) and the effect on property values (r=0.173, p<0.01) to be less positive than men (see Table 4). As show in in Table 5, women also ranked the importance of CAFO provision of jobs in the community (r=-0.147, p <0.05) to be lower than men.

Thus, although Hispanics perceived lower risk and higher benefits than non-Hispanics, women perceived higher risk and lower benefit than men.

		Educational	Hispanic	Agricultural
Scale	Gender	Attainment <sup>23</sup>	or Latino	Worker
Environmental Pollution Effect	0.173**	-0.167**	-0.127*	-0.066
Human Health Effect	0.102	-0.092	-0.130*	-0.024
Economic Contribution	0.141*	-0.031	-0.129*	-0.065
Property Value Effect	0.173**	-0.113	-0.144*	-0.077

**Table 4:** Summary of CAFO Risk and Benefit Perception Correlations using the Spearman rho Rank Order Correlation Test (n=296)

\*p < 0.05, \*\*p < 0.01

**Table 5**: Summary of CAFO Rank Order of Importance Correlations using the Spearman rhoRank Order Correlation Test

		Educational	Hispanic	Agricultural
Scale	Gender	Attainment <sup>24</sup>	or Latino	Worker
Environmental Impact ( $n = 283$ )	0.135*	0.068	0.001	-0.054
Community Human Health Impact	0.070	-0.081	-0.099	-0.050
(n= 279)				
Regional Economic Impact (n= 278)	-0.115	-0.045	-0.098	0.068
Provider of Jobs in the Community	-0.147*	0.112		0.062
Impact $(n=285)$			0.255***	

\*p < 0.05, \*\*p < 0.01, \*\*\* p < 0.001

 $<sup>^{23}</sup>$  (n=247) 49 respondents unwilling to indicate education level, and thus were not included in correlation tests.

 $<sup>^{24}</sup>$  (n=247) 49 respondents unwilling to indicate education level, and thus were not included in correlation tests.

### **Research Limitations**

This case study represents the perceptions of community members located within the boundaries of the Macatawa watershed. The embedded community context of this research design limits the generalizability of the research findings to other regions. Several other research limitations should also be taken into consideration. First, our sample of Hispanic farmworkers was affected by the time of year we conducted our survey and some displayed a certain amount of apprehension about indicating farmworker status. When we began collecting surveys in October, 2010, many farms had laid off workers for the season. The end of the agricultural season affected not only our Hispanic farmworker sample, but also the overall sample of farmers and farmworkers was lower than anticipated. We have no reason to believe that our sample was biased as we specifically worked with agencies that served the farmworker population to obtain a cross-section of workers. Thus our representative sample is unlikely to be qualitatively different from the larger population of farmworkers in the area. Our survey did not capture the political orientation or income of respondents, which could have helped to more fully explain risk and benefit perceptions. We chose not to measure these demographic categories based on feedback from interviews with community stakeholders that suggested that surveys conducted previously in the community seeking such descriptive demographic data were perceived as invasive and unlikely to be kept confidential. Last, quantitative analysis of interactions between demographic categories was beyond the scope of this research. Thus in combination with the lack of political orientation/income variables our data is somewhat limited, but it still provides a baseline of race and gender for additional research to build on.

### Discussion

This research builds on the prior environmental justice literature by investigating community perceptions of environmental risks and potential economic benefits of industry beyond the context of geographic inequity and by also including socio-demographic characteristics other than race. Using risk perception theory as a frame, our objectives in this study were to investigate the differences in perceptions within the community regarding CAFOs and to specifically examine the relationship between risk and benefit perceptions of two populations: Hispanic community members and farmworkers. We hypothesized that community perceptions would vary by demographic group. Specifically we hypothesized that perceptions would differ by gender, with women being more likely to display higher perceptions of environmental risks, and minorities (Hispanic community members) to perceive lower likelihoods of risk associated with CAFOs.

Our findings suggest that gender is associated with environmental risk perceptions, and that this may be related to the community context of the environmental hazard. However, there was no discernable gender association with the perception of human health risks. This may be due to the more visible message of water quality impacts related to agriculture activity in the watershed promoted by local groups. The demographic variable of educational attainment was relatively insignificant in our findings, and this may be partially attributed to the number of respondents who were unwilling to provide this data. There was an association between higher levels of educational attainment and increased perception of environmental pollution risk. The relationship between higher levels of education and increased environmental concern has been documented before, with the assumption that those with more education are better able to locate and understand information related to environmental problems (Van Liere and Dunlap, 1980).

However, education is often used in combination with income and occupational prestige as a measure of social class, and many of these studies have been predicated on the membership rolls of environmental non-profit groups (Buttel and Flinn, 1978). Relying on this type of data is problematic as environmental organizations often require membership fees, and thus the participation rates of lower income (and potentially less educated) community members are likely a function of economic ability and not concern. With regard to our results, more attention should be given to whether higher levels of education provide a tool-kit to understand scientific environmental information, such as the available data on CAFOs, rather than as a proxy of social class. The association between minority status and lower perceptions of risk was demonstrated. Hispanic community members did perceive lower likelihoods of environmental pollution and human health risks associated with CAFOs than non-Hispanic community members.

Further, we hypothesized that Hispanic community members would display an inverse relationship between their risk and benefit perceptions and this was supported by our results. Based on the strength of the association between Hispanic race/ethnicity status and the perceived economic importance of CAFOs, these findings suggest that the direct employment (or the desire to be employed by the agriculture industry) of this population, mediates some risk. Unanticipated by our framework was the association between gender and perception of potential CAFO benefits. Our findings suggest that women may be less likely to associate economic benefits with an industry that they perceive to be an environmental risk to their community. Within the study area, this is likely due to women being less dependent on CAFOs for employment in the community. There were no women employed as farmworkers at either of the CAFOs we toured, one of which is the largest in the study area. Further, within the survey sample there were only twenty women who were currently working, or had experience working, on any type of farm.

Thus in the absence of perceived or direct employment benefits, the potential risks to the environment are more salient to this group.

There are several theoretical implications of our results. First, following the lead of Jones and Rainey (2006), our findings extend the scope of environmental justice based research. Our results indicate that there are additional factors other than exposure to a potential environmental hazard that influence perception. Importantly, our results suggest that the perceptions of women and the perceptions of minorities are not the same, despite their frequent co-labeling within environmental justice literature as marginalized populations. This continues the line of research that suggests the perceptions of women and minorities are not homogenous and that more attention should be paid to the individual social contexts of group membership (Rivers et al., 2010). Research which neglects to treat these groups as composed of individuals who possess varying perceptions can lead to not only skewed results, but faulty assumptions about the information and educational needs of communities. By including additional sociodemographic variables in our investigation that produced distinctly different characterizations of risk, our results support the inclusion of the entire community's perceptions in environmental justice research rather than one specific 'disadvantaged' group. Further, it lends support to the arguments of Taylor (2000) and Schlosberg (2007) that including more communities in an EJF can increase the sensitivity and nuance of analysis.

Additionally, we found that Hispanic community members were more concerned with the economic benefits of CAFOs than potential environmental and health impacts, which echoes the framework of the economic contingency hypothesis (Jones and Dunlap, 1992). Of note is the correlation between Hispanic race/ethnicity and the rank of importance attributed to CAFO jobs in the community. This finding, combined with our results indicating lower perceptions of risk

for this same population, finds support in the work of Sokolowska and Tyzka (1995). They suggest that marginalized community members will be more tolerant of environmental/health risks for the possibility of local employment. From our results it appears that the economic dependency on agricultural jobs of Hispanic community members is influencing their judgment of environmental and public health related impacts. The importance of our findings related to the differing perceptions for women and minorities suggest that both the environmental justice and risk perception literatures would benefit from further studies that incorporate both theoretical frameworks. By including risk perception theory environmental justice investigations could increase their academic rigor and further explore perceptions of procedural equity and inequity in communities. Risk perception studies often comment on the possibility of environmental injustices in their discussion, but fail to integrate the environmental justice framework to studies of variation in perception by race, gender, and worldview could produce important practical applications for environmental policy processes.

From a practical standpoint, our results suggest that the economic importance of agriculture in this region may be affecting the environmental and public health decision-making of this community. The current political and regulatory structure of Michigan and related agricultural agencies favor the CAFO model, suggesting that information from these sources is unlikely to focus on risk, and instead privilege economic gain. Additionally, there are only two opportunities for community members to interact with regulatory oversight of CAFOs. They may call in a complaint to the state environmental agency, or in the case of new/expanding CAFO, they may participate in a public hearing. Given that Hispanic community members, farmworkers, and men all perceive a lower likelihood of environmental or human health effects, it is unlikely

that this community would protest future CAFO development. This is problematic given the research that associates CAFO density with increased air pollution (Mirabelli et al., 2006), water pollution (Oemke, et al., 2004), farmworker health impacts (Wing et al., 2000) and decreased property values (Abeles-Allison and Connor, 1990). Beyond a discussion of public participation rates the perceived risk associations of these groups do not reflect the results of scientific research, which may affect their own level of personal safety and their families. Given the evidence of inverse risk/benefit relationships in this community, careful attention should be given to how to responsibly educate citizens about environmental and public health impacts from this industry. Additionally the apprehension expressed by many Hispanic community members to designate on a paper form that they worked on a farm for fear that their employer (or potential employer) would see their results indicates that this group is unlikely to voice concern or seek personal safety information. Currently there is no information at the state or county level about CAFOs in Spanish which may contribute to this population's lowered risk perceptions. Seventy eight percent of our Hispanic respondents spoke English as a second language. Indeed, for the whole community information may only be accessed via the Internet, and much of the data about CAFOs in their community may only be retrieved after completing a Freedom of Information Act (FOIA) request. Thus it is not only the Hispanic population, but likely the entire community that is impacted by barriers to knowledge.

### Conclusion

This study contributes to both the environmental justice and risk perception literatures by investigating and describing the response of a community to CAFOs in their region. We have provided not only a baseline of risk and benefit perceptions associated with CAFOs, but a

framework for other scholars who wish to continue this type of research in Michigan and elsewhere. By incorporating risk perception theory into our research we have broadened the scope of the EJF, by first including community perception and investigating beyond the presence of geographic inequity.

Building on the current study, future research of CAFO impacts on communities should capture the political orientation and income levels of community members. These two factors are associated with lower perceptions of risk, and may help to explain community response. Further, larger sample sizes and sophisticated statistical analysis, which are less common to case studies, should be undertaken to allow analysis of the interactions between demographic categories. In Michigan specifically, further research is needed to investigate the possibility of geographic inequities in CAFO location, and potential barriers to public participation in regulatory forums. Our study established a baseline of community perception of CAFO impacts. While our findings are significant, and a practical contribution to the discourse about CAFOs in Michigan, future research should explore more specific constructs of CAFO risks, and the role of information access to the knowledge and perceptions of CAFOs in communities.

### **Conclusion of Thesis**

In this final chapter I provide an overview of additional research findings not presented within the article in Chapter 2. Next, I discuss areas for future research and the contributions and limitations of my case study.

#### **Additional Findings**

As mentioned in Chapter 1, this case study included semi-structured interviews, participant observation and archival research as additional sources of data beyond the orally administered survey. A finding of both the interview stage and my periods of participant observation was the interest in having more information related to CAFOs available in the community, and specifically in Spanish. Two interview respondents, who represented Hispanic advocacy groups and local governance respectively, noted that they were not aware of any information related to CAFOs being available in Spanish from their organization or any other. Echoing this theme were migrant farmworkers and Hispanic community members from my participant observation sessions. Not only did these respondents request more information related to employment and potential health impacts, but they expressed interest in having me, or someone from my "organization," come back and share material with them. To support these findings I performed my own archival research to see if I could locate information. Second, I included a question in the orally administered survey that asked respondents if they ever needed or wanted more information related to CAFOs in their community, and if yes, what type of

information. Twenty-three percent of survey respondents indicated that they did want more information. A summary of my archival research and survey responses follows.

### **Archival Findings**

An immediate concern was the almost exclusive reliance of state government agencies on the internet as a communication portal with the public. All information related to the MDEQ oversight of CAFOs was accessible solely through the internet. This includes the scope of NPDES permits, frequently asked questions regarding CAFOs in Michigan, a downloadable list of permitted CAFOs, and links to legislative updates of regulatory changes. Portions of new permits that would include potential water discharges are required to be made available for public notice, but are not archived on the website.

The *digital divide* still exists within low income, low education, and minority communities, and it is especially prevalent in rural areas (Benton Foundation, 1998). This suggests that the two populations of interest within our case study, farmworkers and Hispanic community members may be affected by this phenomenon. Differing access to technology cannot only increase social polarization between advantaged and disadvantaged groups in terms of "resources," but in the case of information located on the Internet, it can limit the ability to participate in decision-making (Castells, 1989; Kellog et. al, 2003). Generally, the U.S. population has low levels of science literacy/numeracy, which can make the communication of environmental and public health data difficult (Lipkus et. al, 2001). Combining this lack of literacy with the potential lack of access to information in the first place demonstrates the significant impediment to the ability of some marginalized groups to integrate this data into their

knowledge base. This restricts their ability to effectively participate in public policy discourse, a requirement for procedural justice (Bullard, 1990).

Assuming that residents within our study had access to the internet, and knew that CAFOs were under the purview of the MDEQ, it takes seven links to navigate from the home page to the NPDES/CAFO page. Within this series of seven links, residents would have to correctly guess that CAFOs would be regulated under the Surface Water department, rather than Water Quality, Drinking Water, Water Management or Water Security. If a community member wanted information directly related to farms in their community, they must complete a Freedom of Information Act (FOIA) request for each farm. FOIA requests may be completed via the Internet. However, a resident completing an internet request will not know the content of the data they are requesting, as this is unavailable on-line. FOIA requests may also be completed in person, by visiting the satellite office from which the CAFO is monitored. For the farms included in our study area, these satellite offices are in Grand Rapids or Kalamazoo which may be an impediment for those without transportation or the ability to take time off from work during the business day. Some farm facility map, permits, and CNMP have been scanned, and are available electronically after a successful FOIA request. However the majority are still hard paper files, and the requestor must pay for each sheet of paper, as well as the time of the office staff who copied the documents. In person requests must be completed during normal business hours, typically 8am-4:30pm, Monday through Friday. This combination -- the difficulty of navigating the Internet, the need to travel to these offices during working hours and the monetary expense approximately \$100 per file— creates significant barriers for any community resident, but especially Hispanic community members. Hispanics are less likely to use the Internet to find health related information and the odds of seeking information from the Internet decreases even

more among Hispanics who make \$25,000 or less per year (Pena-Purcell, 2008). This would suggest that Hispanic agricultural workers in our study would be especially impacted by internet-only systems.

### **Qualitative Survey Findings**

In addition to asking survey respondents if they have ever needed or wanted information, respondents were asked what type of information they sought. In support of my quantitative findings presented in Chapter 2, several of the Hispanic community members expressed a desire for more information related to employment:

"To know how to get a job and I like to know things."

"I would like to be more farms, but only if they have jobs for us Latinos."

"To have education about the work. I was not successful (in finding this information) it was not clear."

"How to get work there."

Interestingly, some Hispanic farmworkers spoke about their concern related to potential human health effects, despite my earlier findings that this population perceived a lower risk of

this type of impact from CAFOs:

"Because sometimes we do not know the chemicals we work in."

"For prevention of sickness. They (CAFOs) pollute but we need them."

"So I would know what is going on in the farms near my house. Whether it will cause a disease if I breathe it in."

These responses suggest that at least some Hispanic farmworkers are aware that there may be health related risks associated with CAFOs. However, as indicated by our quantitative findings, this population is likely to display an inverse relationship between their risk and benefit perceptions. Thus, the benefit of employment, may mediate the risk perceptions related to human health.

To conclude my overview of the case study findings I provide a chart of the power differentials between the industry model of CAFOs and the "community." This graphically illustrates the avenues through which CAFOs and community members exercise individual and group power within the study area, and in some cases the state of Michigan.

## Figure 2: Power relationships between CAFO structure and communities

## **Power of CAFOs**

**Increased by:** Economic Importance to State and Region

Regulatory flexibility of GAAMPs

Protection from nuisance lawsuits and citizens' complaints in the Right to Farm Act

FOIA protection status of violations

**Decreased by:** Permit requirements of the NPDES

The inclusion of the antidegradation demonstration within siting and expansion request

Lawsuits and attention from State and US level environmental advocacy groups

## **Power of Community**

## Increased by:

Ability to bring public comment during antidegradation demonstration of the CAFO

Lawsuits and attention from State and US level environmental advocacy groups

## Decreased by:

Dependence on industrial farming for jobs

Restrictions to information based on limited data sets, Agency MOUS, technology access

Disincentive to advocate because of 3 strike rule in Right to Farm Act

Reduced effectiveness in public debate because of incomplete knowledge

### **Future Research**

In the absence of readily available knowledge or information of an industry or technology, social trust in institutions is the significant determinant of perception (Knight, 2007). The current political and regulatory structure of Michigan and related agricultural agencies favor the CAFO model, suggesting that information from these sources is likely to focus on the economic benefit of industrialized agriculture to Michigan's economy. Further, even if reliable environmental and public health information from trusted sources were available to the community, the information may be discounted in favor of employment opportunities. If the risk information relayed does not fit with strongly held opinions, it is unlikely to be incorporated into an individual's risk perception at any time (Sjoberg, 2000). In our study population, Hispanic community members and farmworkers would be more likely to reject information on environmental and/or health risks as employment will be viewed very positively.

However, to simply accept this relationship would be to ignore the environmental justice frame of my research. Second, it would discount the experience of the Hispanic respondents in my survey who were apprehensive about indicating that they were farmworkers, or those who expressed that they wanted more information, but in both cases feared they would lose their jobs. The risks to the environment and human health associated with CAFO farming models have been documented by other researchers, and reviewed within this project. Within the State of Michigan, access to information related to CAFOs appears limited, especially to members of the Hispanic farmworker community who speak English as a second language. The potential barriers to information and employment anxiety are both conditions that could affect participation rates, and thus the procedural equity of this community. Future research efforts should more fully investigate the potential barriers to information access that communities, and especially

marginalized groups, may experience. Second, studies should measure the knowledge of public and environmental health risks associated with CAFOs versus the perception of these risks. It may be that some of the decreased risk perception I captured was a function of the limited comprehensible information available to these populations.

### **Research Limitations**

The use of a case study design limits the generalizability of my results to other regions. The findings presented here are embedded within the specific location, socioeconomic, and political contexts of my chosen study area. However, while critics of this method cite these limits, the intent of this design is to contribute specific case evidence to theory (Yin, 1984, 2003). Within the research presented here, there are two areas for contribution. First, I illustrate how the theoretical ideas of the inverse relationship of risk and benefit analysis and the primacy of economic need affect judgments. Second, I provide a report that might be used as a reference for others who are interested in studying the environmental justice implications of industrial farming. APPENDICES

## Appendix A: Semi-structured Interview Topics and Sample Questions

## **Topic- Political Positioning**

- 1. If industrial sized farms (or your farm) were to continue to expand or site in your county/district, how do you think this would impact the community?
- 2. In general, what do you think the local majority opinion is of industrial farms?
- 3. Are you aware of the community protest which occurred in St. Joseph County? If presented with that same opportunity, how do you think community residents here would respond?

## **Topic- Economic Impacts**

- 1. How do you think industrial farms contribute to the economy of this community?
- 2. How would you describe the change in the local agricultural market since industrial farms began locating in your community?
- 3. Given the change you described in the local market, do you think that city managers/governance encourage/discourage the growth of industrial farms in this area?

## **Topic- Environmental Health Impacts**

- 1. How would you describe the environmental impact of industrial farms in this area or in general?
- 2. Do you think community residents share your opinion, or how do you think their opinion differs?
- 3. How do you think community residents get their environmental information? From state agencies, advocacy groups, hearsay?

## **Topic- Public Health Impacts**

- 1. Are you aware of any human health effects associated with industrial farms?
- 2. How would you describe the community impression of industrial farms as it relates to public health issues?

## Sample Questions for Specific Stakeholder Groups

### **CAFO Owner**

- 1. How would you describe the regulatory procedures surrounding your farm?
- 2. What has been your impression of this community's opinion of CAFOs? What about specific to the environment? The economy?
- 3. Do you think that it would be beneficial for the community to be more involved/informed about the nature of your farm?

### **Local Governance**

- 1. How would you describe the contribution of industrial farms to this community?
- 2. How would you describe the political advocacy level of this community?
- 3. How would you describe the accessibility of public and environmental health information to community residents?

### **Local Environmental Groups**

- 1. How would you describe the political advocacy level of this community?
- 2. Do you see difference in participation rates based on education/gender/race/age?
- 3. Would you describe local governance as cooperative in enhancing local environmental and public health knowledge?
- 4. Does your agency have a platform related to agriculture?
- 5. Do you think that this issue would resonate with the community? Why or why not?
6. Based on education campaigns that your agency would describe as successful, what types of media did you find the community most receptive of?

Appendix B: Stakeholder Representatives

Farmers (N=2)

Regulators (N=2)

Environmental Advocacy Groups (N=2)

Hispanic Advocacy Group (N=3)

Local Governance Umbrella Group (N=1)

Farmers Market Administrator (N=1)

### Appendix C: Orally Administered Survey

### **Demographic Information**

- a. Do you work within the agricultural industry in any form? If yes, \_\_\_\_\_?
- b. What is your preferred language for communication?

#### 1. How many industrial farms do you think there are within?

- a. Within 30 miles of your house/work (show with map)
- b. 5 miles of your house/work
- 2. Would you like there to be more or fewer of these farms near where you live?
  - a. Why?

### 3. Do you think there is a difference in land use between industrial size farms and smaller

#### farms?

a. Why or Why not?

## **4.** In your opinion, which statement best describes the physical effect of industrial farms on the landscape?

- a. I think industrial farms make the landscape:
- 1. Much less attractive.
- 2. Less attractive
- 3. No effect.
- 4. More attractive.
- 5. Much more attractive.

# **5.** In your opinion, which statement best describes the possibility for industrial farms to pollute the environment?

- a. I think it is \_\_\_\_\_ that industrial farms pollute the environment:
- 1. Definite
- 2. Very Probable
- 3. Probable
- 4. Not very probable
- 5. Improbable or Impossible

# 6. In your opinion, which statement best describes the possibility for industrial farms to have an effect on human health? On farm-workers?

- a. I think it is \_\_\_\_\_ that industrial farms effect human health:
- 1. Definite
- 2. Very Probable
- 3. Probable
- 4. Not very probable
- 5. Improbable or Impossible

## 7. How would you rate the importance of the economic contribution of industrial farms to this community?

- 1. Not important
- 2. Of little importance
- 3. Neutral
- 4. Important
- 5. Very important

# **8.** In your opinion, which statement best describes the effect industrial farms in this area may have on property values?

a. I think that the presence of industrial farms in this area has a \_\_\_\_\_ on property

values.

- 1. Very negative effect.
- 2. Some negative effect.
- 3. No positive or negative effect.
- 4. Some positive effect.
- 5. Very positive effect

### 9. Please rank the following issues in the order of importance for you

When I think about the impact of industrial farms in my community, I think this is the

most important issue:

1= Most important, 4= Least important

- A. Regional Economic Impact
- B. Environmental Impact
- C. Provider of Jobs
- D. Community Human Health Impact

10. Why is \_\_\_\_\_ the most important to you? How would you describe the impact (positive or negative)?

11. Could you give me one positive and one negative effect that you think industrial farms have on the local environment?

12. Could you give me one positive and one negative effect that you think industrial farms could have on quality of life/health in the local community?

**13.** Have you ever needed or wanted more information about industrial farms in this community?

a. Yes or No? If Yes: 1. Why?

- 2. What kind of information about these farms did you need or want?
- 3. Where did you search for this information?
- 4. Was it in a format that you were able to use?
- 5. Were you successful in obtaining the information you needed or wanted?
- 6. Was there anything that could have made the information gathering process better?

#### Demographic Information to be collected post survey- this information is voluntary

Gender:

Race/Ethnicity:

Age Bracket:

[ ] 18-29 [ ] 30-39 [ ] 40-49 [ ] 50-59 [ ] 60-69 [ ] 70-79

[ ] 80 and over

Educational Attainment:

- [ ] Did not graduate high school
- [ ] High School or GED
- [ ] Some college/Associate's Degree/Professional Certification
- [ ] Bachelor's degree or higher

BIBLIOGRAPHY

### BIBLIOGRAPHY

Abeles–Allison, Mark and Larry J. Connor. (1990). *An Analysis of Local Benefits And Costs of Michigan Hog Operations Experiencing Environmental Conflicts*, Agricultural Economics Report #536. Department of Agricultural Economics. Michigan State University.

Alhakami, A., & Slovic, P. (1994). A psychological study of the inverse relationship between perceived risk and perceived benefit. *Risk Analysis*, 14(6), 1085–1096.

Arvai, J. L. (2007). Rethinking of risk communication: lessons from the decision sciences. *Tree Genetics and Genomics*, 3(2), 173–185

Ash, Michael, and T. Robert Fetter. (2004). Who lives on the wrong side of the environmental tracks? Evidence from the EPA's risk–screening environmental indicators model. *Social Science Quarterly* 85(2),441–462.

Axinn, W.G., and Pearce, L.D. (2006). *Mixed method data collection strategies*. Cambridge University Press.

Benton Foundation. 1998. Losing ground bit by bit. Retrieved 2008, from <u>http://benton.org/library#thedigitaldivide</u>.

Blahna, D.J., and Yonts–Shepard, S. (1989). Public involvement in resource planning: Toward bridging the gap between policy and implementation. *Society & Natural Resources*, 2(1), 209–227.

Bord, R.J., and O'Connor, R.E., (1992). Determinants of risk perceptions of a hazardous waste site. *Risk Analysis*, 12(3), 411–416.

Brown, M.H. (1980). *Laying waste: The poisoning of America by toxic chemicals*. New York: Pantheon Books.

Bryant, B. (1995). *Environmental justice: Issues, policies, and solutions*. Covelo, CA: Island Press.

Bryant, B., and Mohai, P. (1992) *Race and the incidence of environmental hazards: A time for discourse*. Boulder, CO: Westview Press.

Bullard, R. (1983). Solid waste sites and the Houston black community. *Sociological Inquiry*. 53:273–288.

Bullard, R., (1990). *Dumping in dixie: Race, class, and environmental quality*. Boulder, CO: Westview Press.

Bullard, R., (1993). *Confronting environmental racism: Voices from the grassroots*. Boston, MA: South End Press.

Bullard, R., (1994). *Unequal protection: Environmental justice and communities of color*. San Francisco, CA: Sierra Club Books.

Buttel, F.H. and Flinn, W.L. (1978). Social class and mass environmental beliefs: A reconsideration. *Environment and Behavior*, 10:433–450.

Campagnolo, E.R., Johnson, K.R., Karpati, A., Rubin, C.S., Kolpin, D.W, and Meyer M.T. (2002). Antimicrobial residues in animal waste and water resources proximal to large–scale swine and poultry feeding operations. *Sci Total Environ*, 299:89–95.

Capek, S. (1993). The "environmental justice" frame: A conceptual discussion and an application. *Social Problems*, 40(1), 5–24.

Castells, Manuel. (1989). *The informational city: Information technology. Economic restructuring, and the urban–regional process.* Oxford: Basil Blackwell.

Collins, P. H. (2006). *From black power to hip hop: racism, nationalism, and feminism.* Philadelphia, PA: Temple University Press.

Cochrane, W. W. (1993). *The development of american agriculture: A historical analysis.* Minneapolis, MN: University of Minnesota.

Cole, D., Todd, L., and Wing, S. (2000). Concentrated swine feeding operations and public health: a review of occupational and community health effects. *Environmental Health Perspectives*, 108: 685–699.

Davis, G. (1996). *Consultation, public participation and the integration of multiple interests into policy making.* Paris: Organisation for Economic Co–operation and Development.

Day, D. (1997). Citizen participation in the planning process: An essentially contested concept? *Journal of Planning Literature*, 11(3), 421–34.

Donham, K. J. Wing, S. Osterberg, D. Flora, J. L. Hodne, C. Thu, K. M., and Thorne, P. S. (2007). Community health and socioeconomic issues surrounding concentrated animal feeding operations. *Environmental Health Perspectives*, 115(2), 317–320.

Finucane, M.L., Slovic, P., Mertz C.K., Flynn, J., and Satterfield, T.A. (2000). Gender, race, and perceived risk: The "white male" effect. *Health, Risk and Society*, 2: 159–172.

Finucane, M.L., Alhakami, A., Slovic, P., and Johnson, S. M. (2000) The affect heuristic in judgments of risks and benefits. *Journal of Behavioral Decision Making*, 13:1–17.

Fischoff, B. (1995). Risk perception and communication unplugged: Twenty years of process. *Risk Analysis*, 15(2) 137–145.

Flynn, J., Slovic, P., and Mertz, C.K. (1994). Gender, race and perception of environmental health risks. *Risk Analysis*, 14:1101–1108.

Frewer, L. (1999) Risk perception, social trust, and public participation in strategic decision making: Implications for emerging technologies. *Ambio*, 28(6), 569–574.

Fricker, Jr., R. D. and Hengartner, N.W. (2001). Environmental equity and the distribution of toxic release inventory and other environmentally undesirable sites in metropolitan New York City. *Environmental and Ecological Statistics* 9:33–52.

Gelobter, M. (1987). *The distribution of outdoor air pollution by income and race: 1970–1984*. Berkely, CA: University of California.

Getches, D.H., and Pellow, D.N. (2002). Beyond traditional environmental justice. In K. Mutz, G. Bryner, and D. Kenney (eds.), *Justice and natural resources: Concepts, strategies, and applications*. Washington, DC: Island Press.

Goldman, B. (1991) *The truth about where you live: An atlas for action on toxins and mortality.* New York: Random House.

Hamilton, L.C. 91985a). Concern about toxic wastes: Three demographic predictors. *Sociological Perspectives*, 28(4), 463–486.

Hamilton, L.C. (1985b). Who cares about water pollution? Opinions in a small town crisis. *Sociological Inquiry*, 55(2), 170–181.

Heederik, D. Sigsgaard, T. Thorne, P. S. Kline, J. N. Avery, R. Bonlokke, J. H. Chrischilles, E. A. Dosman, J. A. Duchaine, C., and Kirkhorn, S. R. (2007). Health effects of airborne exposures from concentrated animal feeding operations. *Environmental Health Perspectives*, 115(2), 298–302.

Hunold, C., and Young, I.M. (1998). Justice, democracy, and hazardous siting. *Political Studies*, 46(1), 82–95.

Irvin, R.A., and Stansbury, J. (2004). Citizen Participation in Decision Making: Is It Worth the Effort? *Public Administration Review*, 64 (1),55–65.

Jamieson, S. (2004). Likert scales: How to (ab)use them. *Medical Education*, 38(12), 1217–1218.

Johnson, B. (2002). Gender and race in beliefs about outdoor air pollution. *Risk Analysis*, 22(4), 725–738.

Jones, R. E., & Dunlap, R. E. (1992). The social bases of environmental concern: Have they changed over time? *Rural Sociology*, 57(1), 28–47.

Jones, R.E., and Rainey, S.A. (2006) Examining linkages between race, environmental concern, health, and justice in a highly polluted community of color. *Journal of Black Studies*, 36(4), 473–496.

Kellog, W.A., and Mathur, A. (2003). Environmental justice and information technologies: Overcoming the information–access paradox in urban communities. *Public Administration*, 63(5), 573–585.

Knight, A. (2007) Intervening effects of knowledge, morality, trust, and benefits on support for animal and plant biotechnology. *Risk Analysis*, 27(6), 1553–1563.

Kross, B.C., Ayebo, A.D., and Fuortes, L. J. (1992). Methemoglobinemia: nitrate toxicity in rural America. *American Family Physician*, 46(1), 183–188.

Lipkus, I. M., Samsa, G., and Rimer, B. K. (2001). General performance on a numeracy scale among highly educated samples. *Medical Decision Making*, 21(1), 37–44.

Lobao, L.M. (2000). Industrialized farming and its relationship to community well-being: report prepared for the state of South Dakota. Office of the Attorney General, Pierre, South Dakota.

Lobao, L., and Meyer, K. (2001). The great agricultural transition: Crisis, change, and social consequences of twentieth century US farming." *Annual Review of Sociology*, 27:103–124.

Loewenstein, G. F., Weber, E.U., Hsee, C.K., and Welch, N. (2001). Risk as feelings. *Psychological Bulletin*, 127(2), 267–286.

MacGregor, D., Slovic, P., Mason, R.G., Detweiler, J., Binney, S.G., and Dood, B. (1994). Perceived risks of radioactive waste transport through Oregon: Results of a statewide survey. *Risk Analysis*, 14(1), 5–14.

Maxwell, J.A. (2005). *Qualitative research design: An interactive approach*. Second edition. Volume 41 in series: Applied social research methods series, L. Bickman and D. J. Rog (eds.). Thousand Oaks, CA: Sage Publications.

McAdams, D., McCarthy, J.D., and Zald, M. N. (eds.), (1996). *Comparative perspective on social movements: Political opportunities, mobilizing structures, and cultural framings.* Cambridge University Press.

McMichael, P. (2003). Global development and the corporate food regime. *Research in Rural Sociology and Development*, 11: 265–300.

Michigan Department of Environmental Quality (2008). Press Release, Retrieved, 2009, http://www.michigan.gov/deq/0,1607,7–135–3308\_3323–195296—,00.html. Michigan Department of Environmental Quality (2005). Macatawa river watershed hydrologic study. Retrieved, 2009, http://www.michigan.gov/documents/deq-water-mgmt-macatawa\_4698\_7.pdf

Mirabelli, M. C., Wing, S., Marshall, S. W., and Wilcosky, T. C. (2006). Race, poverty, and potential exposure of middle school students to air emissions from confined swine feeding operations. *Environmental Health Perspectives*, 114(4), 591–596.

Mohai, P., and Saha, R. (2006). Reassessing racial and socioeconomic disparities in environmental justice research. *Demography* 43(2), 383–399.

Mohai, P., and Saha, R. (2007). Racial inequality in the distribution of hazardous waste: A national-level reassessment. *Social Problems* 54(3), 343–370.

Oberschall, A. (1973). Social conflict and social movements. Englewood Cliffs., N.J: Prentice-Hall.

Oemke, M. P., Borrello, M. C., Snowden, L., and Farley, A. (2004). Determining impacts of confined animal feedlot Operations (CAFOs) on the water quality and periphyton community in two Mid–Michigan streams. *American Geophysical Union*, Fall Meeting.

Pallant, J. (2010). SPSS survival manual: A step by step guide to data analysis using the SPSS program. Fourth Edition. Berkshire: Open University Press.

Pellow, D.N., and Brulle, R. (2005). *Power, justice, and the environment: A critical appraisal of the environmental justice movement.* Cambridge, MA: MIT Press.

Pena–Purcell, N. (2008). Hispanics' use of Internet health information: an exploratory study. *Medical Library Association*, 96(2), 101–107.

Perfecto, I., and Velisquez B. (1992). Farm workers: among the least protected. *EPAJ* 18(1),13–14.

Rivers, L., Arvai, J., and Slovic, P. (2010). Beyond a simple case of black and white: Searching for the white male effect in the african–american community. *Risk Analysis*, 30(1), 65–77.

Rosenbaum, P.R. (2001). Replicating effects and biases. American Statistician, 55(3),223-227.

Russell, S., and Vidler, E. (2000). The rise and fall of government–community partnerships for urban development: Grassroots testimony from colombo. *Environment and Urbanization* 12(1), 73–86.

Sicotte, D. (2009). Power, profit, and pollution: The persistence of environmental injustice in a company town. *Research in Human Ecology*, 16(2), 141–150.

Schlosberg, D. (2007). *Defining environmental justice: Theories, movements, and nature*. Oxford: Oxford University Press.

Shrader–Frechette, K. (2002). *Environmental justice: creating equality, reclaiming democracy*. Oxford: Oxford University Press.

Sjoberg, L. (2000). Factors in risk perception. Risk Analysis, 20(1), 1–11.

Slovic, P. (1987). Perception of risk. Science, 236: 280-285.

Slovic, P., Fischoff, B., and Lichenstein, S. (1982). Why study risk perception. *Risk Analysis*, 2(2) 83–93.

Slovic, P. and Peters, E. (1998). The importance of worldview in risk perceptions. *Risk, Decision & Policy*, 3(2), 165–170.

Smith, P. D., and McDonough, M.H. (2001). Beyond public participation: Fairness in natural resource decision making. *Society and Natural Resources* 14(3), 239–49.

Snow, D.A., and Benford, R.D. (1992). Master frames and cycles of protest. In Morris, A.D. and Mueller C.M. (eds.), *Frontiers in social movement theory*. Yale University Press.

Sokolowska, J., and Tyszkal, T. (1995). Perception and acceptance of technological and environmental risks: Why are poor countries less concerned? *Risk Analysis* 15(6) 733–743. Starr, C. (1969). Social benefits versus technological risk. *Science*, 165: 1232–1238.

Taylor, D. (2000). The rise of the environmental justice paradigm: Injustice framing and the social construction of environmental discourses. *American Behavioral Scientist*, 43(4), 508–580.

Tellis, W. (1997). Introduction to case study. *The Qualitative Report* [On–line serial], *3*(2). Available: <u>http://www.nova.edu/ssss/QR/QR3–2/tellis1.html</u>.

Tellis. W. (1997). Application of a case study methodology . *The Qualitative Report* [On–line serial], *3*(3). Available:http://www.nova.edu/ssss/QR/QR3–3/tellis2.html.

United Church of Christ Commission for Racial Justice. (1987). Toxic wastes and race in the United States: A national report on the racial and socio–economic characteristics of communities with hazardous waste sites. New York: United Church of Christ Commission for Racial Justice.

United States Census Bureau: American community survey: 2005–2009. Retrieved 2009, from <u>http://www.census.gov/acs/www/</u>.

United States Department of Agriculture: The census of agriculture. Retrieved 2011, from <u>http://www.agcensus.usda.gov/Publications/2007</u>.

United States General Accounting Office. 1983. Siting of hazardous waste landfills and their correlation with racial and economic status of surrounding communities. GAO/RCED-83-168.

Van Liere, K.D. and Dunlap, R.E. (1980). The social bases of environmental concern: A review of hypotheses, explanations and empirical evidence. *The Public Opinion Quarterly*, 44(2), 181–197.

Vaughan, E. (1993) Individual and cultural differences in adaptation to environmental risks. *American Psychology*, 48:1–8.

Weber, E. P. (2000). A new vanguard for the environment: grass-roots ecosystem management as a new environmental movement. *Society and Natural Resources* 13(3), 237–59.

Wildavsky, A., and Dake, K. (1990). Theories of risk perception: Who fears what and why?. *Daedalus* 119:41–60.

Williams, B. L., Brown, S., and Greenberg, M. (1999). Determinants of trust perceptions among residents surrounding the Savannah river nuclear weapons site. *Environment and Behavior*, 31(3), 354–371.

Wilson, S.M., Howell, F., Wing, S., and Sobsey, M. (2002). Environmental injustice and the Mississippi hog industry. *Environmental Health Perspectives*, 110(2),195–201.

Wing, S., Cole, D., and Grant, G. (2000). Environmental injustice in North Carolina's hog industry. *Environmental Health Perspectives*, 108(3), 225–232.

Wright, G., Bolger, F. and Rowe, G. (2002). An empirical test of the relative validity of expert and lay judgments of risk. *Risk Analysis*, 22(6), 1107–1122.

Yin, R.K. (1984). *Case study research: Design and methods*. Beverly Hills, CA: Sage.

Yin, R. K. (2003). *Applications of case study research*. Applied Social Research Methods Series. Thousand Oaks, CA: Sage.